SEVENTEENTH ANNUAL REPORT

TO CONGRESS

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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A.J. Eggenberger, Chairman
John E. Mansfield
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
(202) 694-7000

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To the Congress of the United States:

The Defense Nuclear Facilities Safety Board is pleased to submit to Congress its Seventeenth Annual Report. The Board is an independent executive branch agency responsible for providing advice and recommendations to the Secretary of Energy, and to the President if necessary, regarding public health and safety issues at the Department of Energy's defense nuclear facilities.

As required by statute, the Board's report summarizes activities during calendar year 2006, assesses improvements in the safety of defense nuclear facilities, and identifies remaining health and safety problems.

Respectfully submitted,

A.J. Eggenberger
Chairman

John E. Mansfield
Member

Joseph F. Bader
Member

Larry W. Brown
Member

Peter S. Winokur
Member

PREFACE

Congress created the Defense Nuclear Facilities Safety Board (Board) as an independent agency within the Executive Branch (42 U.S.C. § 2286, *et seq.*) to identify the nature and consequences of potential threats to public health and safety at the Department of Energy's (DOE's) defense nuclear facilities, to elevate such issues to the highest levels of authority, and to inform the public.

The Board is required to review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements, practices, and events relating to system design, construction, operation, and decommissioning of DOE's defense nuclear facilities. The Board makes recommendations to the Secretary of Energy that the Board believes are necessary to ensure adequate protection of public health and safety. The Board is also empowered to conduct investigations, issue subpoenas, hold public hearings, and establish reporting requirements.

The Board is required by law to submit an annual report to the Committees on Armed Services and Appropriations of the Senate and to the Speaker of the House of Representatives. This report is to include all recommendations made by the Board during the preceding year, and an assessment of: (1) the improvements in the safety of DOE's defense nuclear facilities during the period covered by the report; (2) the improvements in the safety of DOE's defense nuclear facilities resulting from actions taken by the Board or taken on the basis of the activities of the Board; and (3) the outstanding safety problems, if any, of DOE's defense nuclear facilities.

On September 29, 2006, House Conference Report 109-702 on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122) was approved by both houses of Congress. Section 3201 of this report directs the Board to provide to the congressional defense committees quarterly reports to identify and report the status of significant unresolved issues. The first of these reports was submitted by the Board to Congress on February 15, 2007.

The Board is currently evaluating 25 defense nuclear facility design activities with a total project cost of about $20 billion, which includes $12.2 billion for the Hanford Waste Treatment Plant. There are outstanding safety issues associated with many defense nuclear projects that need to be resolved early during the design phase. The Board and DOE are working to arrive at an agreed-upon path forward for resolving these outstanding issues at an early stage in the process.

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Summary of Accomplishments in 2006

The nuclear weapons program of the Department of Energy (DOE), which includes nuclear weapons operations conducted by the National Nuclear Security Administration (NNSA), is a complex and hazardous enterprise. Missions include maintenance of the national nuclear arsenal, dismantlement of surplus weapons, stabilization and storage of surplus nuclear materials, disposition and disposal of hazardous waste, and cleanup of surplus facilities and sites. Some of these missions are carried out with aging facilities while others demand the construction of new facilities. The constant vigilance of the Defense Nuclear Facilities Safety Board (Board) is required to ensure that all of these activities are carried out by DOE in a manner that protects the public, workers, and the environment.

During this past year, actions by the Board resulted in numerous health and safety improvements that are summarized briefly below and in more depth in the main body of the report. These improvements are described in accordance with the Board's four strategic areas of concentration:

- Nuclear Weapons Operations;
- Nuclear Materials Processing and Stabilization;
- Nuclear Facilities Design and Infrastructure; and
- Nuclear Safety Programs and Analysis.

Nuclear Weapons Operations

The Board's strategic performance goal for this area is to ensure that DOE operations directly supporting the nuclear stockpile and defense nuclear research are conducted in a manner that provides adequate protection of the health and safety of the workers and the public. The Board's safety oversight activities in this area focus on assembly and disassembly of weapons; processing and storage of uranium, plutonium, and tritium; and research, development, manufacturing, and testing.

As a result of the Board's efforts during 2006, DOE has taken actions to upgrade the safety of these activities. These actions include improving safety systems and controls in aging facilities, achieving safe packaging of nuclear weapons materials, improving the formality of nuclear explosive and nuclear processing operations, enhancing the quality of engineered safety systems, and correcting deficiencies in the safety bases for new and ongoing activities.

Specific examples of safety improvements in weapons operations made by DOE in consequence of the Board's work are given below. Cross-references are provided to sections in the body of this report where further details can be found.

Multiple Sites:

- DOE is implementing improved requirements for development, evaluation, and documentation of nuclear weapon response to external stimuli. (Recommendation 98-2; Board letter dated December 14, 2005)(Sec. 2.1.1)

- DOE is revising two principal deliverables of its implementation plan for Recommendation 2005-1: (1) the repackaging prioritization methodology, and (2) the nuclear material packaging manual. (Recommendation 2005-1; Board letters dated April 24 and May 1, 2006)(Sec. 2.1.4)

Pantex Plant (Sec. 2.1.1):

- As a part of the implementation plan for Recommendation 98-2, DOE implemented Seamless Safety for the 21st Century processes for weapons programs with insensitive main charge high explosives (the W87, B61, and B83 programs). (Recommendation 98-2)

- DOE completed the safe dismantlement of all W56 war reserve units, including certain units that required the development of new tooling and procedures. (Recommendation 98-2; Board letter dated July 20, 2004)

- DOE is taking a more comprehensive approach toward evaluating multi-unit operations. (staff-to-staff meeting, April 2006)

- DOE completed a three-year effort to implement more than 200 Technical Safety Requirements. (Recommendation 98-2)

- DOE identified actions to improve the nuclear explosive safety process in response to the Top-Down Review advocated by the Board. (staff-to-staff meeting, June 2005)

Y-12 National Security Complex (Sec. 2.1.2):

- DOE is performing maintenance-related structural fixes in the 9212 Complex and plans to increase maintenance funding and pursue other facility infrastructure improvements to reduce material-at-risk in this facility. (Board letter dated April 20, 2005)

- DOE upgraded the classification of key fire protection systems in the 9212 Complex to safety-class. (Board letters dated May 13, 2002 and February 28, 2006)

- DOE developed a plan to improve conduct of operations. (Site Representative Weekly Reports)

- DOE is improving the Uranium Holdup Survey Program. (Site Representative Weekly Reports)

Los Alamos National Laboratory (Sec. 2.2.1):

- DOE took actions to ensure the continuity of the laboratory's institutional corrective actions programs as the laboratory transitioned to a new prime contractor. (Public Hearing, March 22, 2006)

- DOE is examining deficiencies in confinement ventilation at the Plutonium Facility. (Recommendation 2004-2; Board letter dated May 31, 2005)

- DOE developed plans to address deficiencies in fire protection. (Board letters dated March 31, 2003 and May 31, 2005)

- DOE eliminated a single point of failure vulnerability in the high-voltage transmission lines that provide off-site power to the laboratory. (Board letters dated May 5, 1995 and September 22, 1999)

Lawrence Livermore National Laboratory (Sec. 2.2.2):

- DOE was able to resume normal operations in the Plutonium Facility after ensuring that safety-related findings by the Board and DOE's Office of Independent Oversight had been investigated and procedures revised as needed for safe operations. (Board letters dated November 3, 2004 and March 8, 2005)

- DOE developed a revised documented safety analysis for the Plutonium Facility that represents a significant improvement over previous versions of the safety basis for this facility. (Board letter dated May 10, 2006)

- DOE developed procedures and processes to identify and record the configuration of vital safety systems and to begin the process of maintaining a configuration management program for these systems. (Board letter dated November 3, 2004)

Nevada Test Site (Sec. 2.2.3):

- DOE is performing rigorous reviews of the safety bases for subcritical experiments, the Criticality Experiments Facility Project, and defense nuclear facilities. (Board letters dated March 27, 2006 and September 22, 2006)

- DOE continued to make improvements in the facilities and processes necessary to dispose of a damaged nuclear weapon. (Board letter dated June 19, 2006)

- DOE is assessing vital safety systems and safety management programs at the Device Assembly Facility. (Board letter dated November 28, 2005)

- DOE is mapping cracks and water leaks, fixing water leaks, and completing key seismic-related analyses at the Device Assembly Facility. (Board letters dated March 18, 2005 and August 16, 2006)

Sandia National Laboratories (Sec. 2.2.4):

- DOE has continued to correct deficiencies in safety analyses and to remedy significant shortfalls in the site's integrated safety management system. (Board letters dated September 27, 2004 and October 8, 2004)

Nuclear Materials Processing and Stabilization

This area of work includes oversight of DOE's efforts to stabilize remnant materials from past nuclear facility operations, packaging and storage of those materials, and final disposition in approved waste repositories. The Board also monitored DOE's efforts to decontaminate and decommission retired nuclear facilities. Materials included in DOE's stabilization efforts are liquid high-level radioactive wastes, spent nuclear fuel, inactive radioactive actinide materials (which include uranium and plutonium), low-level wastes, and transuranic wastes.

Some of the Board's reviews in this area focused on specific issues at individual facilities, while others involved safety topics with broad implications for multiple defense nuclear facilities. Specific examples of safety improvements made by DOE in response to the Board's actions are given below. Cross-references are provided to sections in the body of this report where further details can be found.

Complex-wide Safety Issues:

- DOE acknowledged safety issues associated with the processing of transuranic waste and drafted a new standard designed to achieve consistency and enhanced safety in handling of transuranic waste across the complex. (Transuranic Waste Authorization Basis Workshop, March 2006; Board letter dated January 29, 2007)(Sec. 3.3.2)

- DOE established a testing program and a new expert panel to study corrosion mechanisms in tanks that store liquid high-level wastes. This currently impacts primarily the Hanford Waste Storage Tanks. (Board letters dated January 18, 2005 and June 1, 2005)(Sec. 3.3.1)

- DOE conducted analyses and identified new safety controls for hydrogen deflagrations in piping and vessels that contain high-level wastes at the Hanford and Savannah River Sites. (Board letters dated November 4, 2002 and October 17, 2005)(Sec. 3.3.1)

Fernald Closure Project:

- DOE safely completed final site closure at the Fernald Site in Ohio. DOE's Office of Environmental Management transferred responsibility for the site to the Office of Legacy Management. (Board letters dated August 7, 2003 and February 2, 2005) (Sec. 3.4.2)

Hanford Site:

- DOE directed that transuranic waste drums found to contain hydrogen gas be vented until the hydrogen dissipates to below 5 percent by volume, instead of 15 percent, which was far greater than the lower flammability limit. (staff-to-staff meeting, March 2006)(Sec. 3.3.2)

- DOE postponed excavation of a burial ground containing spent nuclear fuel and other radioactive material. DOE plans to improve work planning and criticality safety prior to conducting the work. (Site Representative Weekly Reports)(Sec. 3.3.2)

Savannah River Site:

- DOE removed combustible materials from the K-Area Material Storage facility, improving the fire protection posture there. (Annual Reports to Congress on Plutonium Storage at Savannah River Site, 2004, 2005, 2006)(Sec. 3.1.2)

- DOE finished the stabilization of pre-existing neptunium solutions, marking the completion of all Recommendation 94-1 and 2000-1 milestones at the Savannah River Site. (Recommendations 94-1 and 2000-1)(Sec. 3.1.1 and 3.1.4)

Nuclear Facilities Design and Infrastructure

The Board's strategic performance goal for this area is to ensure that new defense nuclear facilities and major modifications to existing facilities are designed and constructed in a manner providing adequate protection of the health and safety of workers and the public. In the past few years, there has been a substantial increase in the number of design and construction projects under the Board's jurisdiction. DOE has undertaken design and construction projects with a projected total cost of about $20 billion. The Board continues to devote extensive resources to ensure that designs for defense nuclear facilities incorporate multiple layers of safety controls commensurate with the hazards.

DOE is not consistently addressing safety issues early in the design process. Moreover, in an increasing number of new projects, DOE planned to make use of closely-coupled "design-build" techniques for large-scale facilities, including some that will require hazardous processes that lack definition. This approach entails considerable risk when combined with DOE's shortage of personnel qualified to adequately manage such projects. To highlight these problems and to gain further information, the Board began a series of public hearings in December 2005 on incorporating safety into design and construction. The series continued through 2006, and the Board is preparing for a third public hearing to be held in the first quarter of 2007. This latest hearing will focus on early issue identification, improved communications between the Board and DOE, and timely resolution of safety issues early in the design effort.

Specific examples of safety improvements in design and infrastructure accomplished as a result of the Board's work are given below. Cross-references are provided to sections in the body of this report where further details can be found.

Hanford Site (Sec. 4.2):

- DOE continued working to correct potential safety flaws in the design of the Waste Treatment Plant. Progress was made in coating of structural steel for fire resistance and the development of design bases for mitigation systems used to prevent hydrogen deflagrations and detonations. DOE also has undertaken a seismic borehole project. The Board expects that ground motion modeling using data due to this drilling program will effectively validate the seismic design ground motion. DOE also developed new structural design criteria to address structural design issues raised by the Board. (Board letters dated October 17, 2005 and September 7, 2006)

- DOE has improved the design for confinement of radioactive materials and worker protection for the Demonstration Bulk Vitrification Project. (Board letter dated September 7, 2005)

- DOE is developing a revised safety basis for the Sludge Treatment Sub-Project of the K-Basin Closure Project. When this work is finished in early 2007, the Board can complete its review of the project's design. (Board letter dated January 5, 2006)

Idaho National Laboratory (Sec. 4.7):

- DOE directed the Integrated Waste Treatment Unit project to use a more conservative and commonly-used computer code for estimating radiological consequences for co-located workers and the public from postulated accidents. Further, the project conducted a review of key safety analysis inputs and subsequently changed them for many of the postulated accidents. These changes resulted in a more technically defensible safety design basis. (Board letter dated January 24, 2007)

Los Alamos National Laboratory (Sec. 4.5):

- DOE decided to classify the fire suppression system and the active confinement ventilation system for the Chemistry and Metallurgy Research Replacement Project facility as safety class and safety significant, respectively. This will be the first DOE facility to be designed and constructed with a safety-class fire protection system. If properly implemented, this action should result in acceptable safety controls for this facility. (staff-to-staff meetings; Site Representative Weekly Reports)

Nevada Test Site (Sec. 4.8):

- DOE is performing a new structural and seismic analysis, plans to address water leaks, and is preparing a new safety analysis for the Critical Experiments Facility. However, the facility structure still has numerous cracks that are considered abnormal for a nuclear facility. The Board is considering further action on this subject. (Board letter dated March 18, 2005)

Savannah River Site (Sec. 4.3):

- DOE undertook an extensive geotechnical site characterization program at the Salt Waste Processing Facility site, involving drilling and sampling of subsurface data, laboratory analysis of samples, and geotechnical analyses. Completion of the geotechnical engineering work at the Salt Waste Processing facility, including comprehensive DOE and peer reviews, will be critical to demonstrating that the design is adequate to withstand seismic hazards. Significant improvements in the structural analysis methodologies are also being implemented. (Board letters dated August 27, 2004 and January 10, 2007)

- DOE successfully and safely started up the Tritium Extraction Facility. (Board letter dated December 19, 2002)

- DOE corrected weaknesses in the hazards analysis for the 3013 Container Surveillance and Storage Capability Project. (Board letter dated January 29, 2007)

Y-12 National Security Complex (Sec. 4.4):

- DOE assigned additional personnel to monitor construction activities at the Highly Enriched Uranium Materials Facility and initiated other corrective actions in response to the Board's observations. (Site Representative Weekly Reports)

Nuclear Safety Programs and Analysis

The Board's strategic performance goal for this area is to ensure that DOE develops, maintains, and implements regulations, contract requirements, guidance, and safety programs that ensure adequate protection of the health and safety of workers and the public. The Board's oversight activities in this area focus on generally applicable safety standards and on issues affecting a variety of defense nuclear facilities.

As a result of the Board's efforts during 2006, DOE has taken actions to strengthen the technical competence of its contractors and federal employees, to establish and implement safety standards, and to improve the quality of engineered safety systems. DOE has also taken measures to enhance the effectiveness of oversight and integrated safety management.

Specific examples of improvements in nuclear safety programs and analysis made in consequence of the Board's work are given below. Cross-references are provided to sections in the body of this report where further details can be found.

- DOE strengthened its directives for oversight of complex, high-hazard nuclear operations and made progress implementing the new requirements in the complex. (Recommendation 2004-1)(Sec. 5.1.2, 5.1.3)

- DOE developed a new integrated safety management manual to clarify its expectations concerning implementation of integrated safety management by DOE personnel. (Recommendation 2004-1)(Sec. 5.1.2)

- DOE developed and implemented a process and criteria for delegating authorities to field personnel for fulfilling assigned safety responsibilities. (Recommendation 2004-1)(Sec. 5.1.2)

- DOE developed and executed a Senior Technical Safety Manager Course. (Recommendation 2004-1)(Sec. 5.1.2, 5.4.1)

- DOE developed a directive on "operating experience" and provided direction and a schedule for implementation. (Recommendation 2004-1)(Sec. 5.1.2)

- DOE established two Central Technical Authorities with associated support staff that centralize technical expertise and operational awareness to assure adequate and proper implementation of nuclear safety requirements. (Recommendation 2004-1)(Sec. 5.1.2)

- DOE strengthened the oversight of nuclear criticality safety through more effective reviews by the Criticality Safety Support Group. (Recommendation 97-2)(Sec. 5.3.6)

- DOE restructured and strengthened the Corporate Technical Intern Program. (Recommendation 2004-1)(Sec. 5.4.1)

- DOE developed and issued a Ventilation System Evaluation Guidance document that identifies a set of design and performance attributes that ventilation systems are being evaluated against for identification of potential upgrades. (Recommendation 2004-2)(Sec. 5.3.2)

Outstanding Safety Problems of Defense Nuclear Facilities

Integration of Safety in the Design of New Defense Nuclear Facilities

The Board believes that improvement in the incorporation of safety in design of new defense nuclear facilities is necessary. Therefore, the Board began a series of public hearings, one in December 2005 and a second in July 2006, concerning the integration of safety in design. During the initial public hearing, the Board focused on the adequacy of DOE's existing directives related to the design of new facilities. As a result of the Board's first public hearing, DOE acknowledged that safety was not being integrated consistently into the early stages of the design of new defense nuclear facilities. DOE is revising its relevant directives. These directives are expected to mandate an appropriate set of requirements designed to better integrate safety into the design of new defense nuclear facilities at the earliest stages of project management.

During the second public hearing, the Board further explored integration of safety in design and the progress being made in implementing DOE's safety in design initiatives. DOE has made some progress in revising its directives. The Order was recently revised to reflect senior DOE management's objective of early integration of safety into the design process. In particular, DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, requires that safety design reports be prepared at the conceptual design and preliminary design stages, in addition to the preliminary documented safety analysis prepared at the final design stage. These

reports are envisioned to contain an evaluation of the safety aspects of the design. The Order delineates the need to charter an Integrated Project Team led by the Federal Project Director at the conceptual design stage and further clarifies the safety role of DOE's Central Technical Authority, Chief of Defense Nuclear Safety, and Chief of Nuclear Safety. These are positive changes that will enhance safety in design.

The Board is being proactive with DOE in promoting the timeliness of issue resolution. The Board's staff has met with DOE headquarters personnel, federal project personnel, and contractor personnel to discuss several key projects, including the Uranium Processing Facility at the Y-12 National Security Complex and the Integrated Waste Treatment Unit at Idaho National Laboratory. These meetings have been aimed at developing a mutual understanding of the safety requirements for these new facilities and establishing common expectations for early design maturity and early identification of safety issues and their resolution.

Finally, the Board has scheduled a third public hearing for March 2007. This hearing will be devoted to early issue identification, communication of Board issues to DOE, issue management, and timely issue closure or resolution.

Reinvigorating Integrated Safety Management

In 1995, the Board issued Recommendation 95-2, urging DOE to integrate work planning and safety planning more effectively. The methodology that evolved from this recommendation and from DOE's implementation plan is termed integrated safety management. Integrated safety management is a structured, comprehensive, common-sense approach to performing work safely. Through integrated safety management, the Board has encouraged DOE to identify and implement measures to protect the public, workers, and the environment from nuclear, chemical, and physical hazards. The identification of hazards and development of protective measures should be integrated.

In 2001, DOE achieved a major goal in its commitment to integrated safety management by verifying through comprehensive assessments that the basic elements of integrated safety management had been implemented at defense nuclear facilities. This was a commendable achievement. Over the next three years, however, implementation faltered. In Recommendation 2004-1, the Board identified the need to reinvigorate integrated safety management through technical and operational excellence based on nuclear safety standards subjected to rigorous oversight. DOE's implementation plan of June 2005, and its subsequent revision in October 2006, contained three major thrusts, one of which directly addresses integrated safety management.

In 2006 the Board closed Recommendation 95-2 after determining that the Recommendation 2004-1 implementation plan and the recently-issued *Integrated Safety Management System Manual* contain the actions necessary to reinvigorate the program. While progress has been made in 2006, overseeing the execution of DOE's implementation plan will continue to be a major focus of the Board's work in 2007.

Reliable Operation of Safety Systems

The Board remains committed to ensuring that DOE properly maintains safety systems at defense nuclear facilities. Many defense nuclear facilities were constructed decades ago. Especially in light of the aging of these facilities, protective features must be maintained in a serviceable and effective condition. For new facilities, on the other hand, the Board focuses its attention on ensuring that safety systems are correctly identified, designed, and constructed.

Unfortunately, the Board continues to identify weaknesses in programs critical to continued reliable operation of safety systems: maintenance, testing, surveillance, quality assurance, detection and removal of counterfeit parts, configuration management, training, conduct of operations, and confinement strategies. DOE is working to make improvements in many of these areas in response to related recommendations from the Board, such as Recommendations 2000-2, 2002-1, 2004-1, and 2004-2. However, as DOE continues to extend the life of aging facilities, and budgets tighten, there is constant pressure to reduce the number of safety systems, to provide less effective maintenance, or to defer necessary infrastructure improvements.

A typical example of this issue exists at the 9212 Complex at Y-12 National Security Complex. This collection of structures, built between 1947 and 1958, has numerous seismic deficiencies, including missing bolts, missing or structurally inadequate braces, and inadequate beam supports. The Board highlighted these issues in letters dated April and November 2005. DOE's response indicated that the main long term action necessary to support safe operation is to construct the planned Uranium Processing Facility, which will be designed to efficiently meet modern safety and security requirements. However, DOE has not fully defined the remedies required to keep the 9212 Complex operational prior to completion of the Uranium Processing Facility. The Board will continue to stress to DOE the importance of ensuring the long-term reliability of vital safety systems and the infrastructure needed to maintain them.

Safe Retrieval, Handling, and Stabilization of Nuclear Materials

The Board continues to provide close oversight of DOE's efforts to safely retrieve, treat, and dispose of high-level wastes, spent fuel sludges, inactive actinides, and transuranic wastes. Many of these activities present significant programmatic and safety challenges to DOE. For example, the project to retrieve radioactive sludges from the K-Basins at the Hanford Site has experienced many delays and cost overruns during the past decade. DOE has isolated some sludge in suitable containers to prevent release to the environment but faces new challenges in safely treating the sludge in a timely fashion.

At both the Hanford Site and the Savannah River Site, DOE is responsible for the safe storage of tens of millions of gallons of high-level waste in tanks that have exceeded their original design lives. While DOE has taken action to prolong the lives of the tanks, high waste levels in the tanks continue to make transfer and treatment operations difficult. Potential waste leaks and mistransfers threaten the safety of workers and the environment. The Board works with DOE to ensure that it continues to focus on the highest priority safety issues.

Many of DOE's facilities around the nation store large quantities of transuranic wastes in drums, a significant portion of which are buried under soil and in poor condition. The drums pose safety hazards, including contamination, high radiation, and potential explosions from the generation of hydrogen gas and volatile organic compounds. The Board has urged DOE to improve the consistency and rigor of the safety controls for these hazards. (Board letters dated January 5, 2006, January 17, 2006, January 18, 2007 and January 29, 2007) Improved safety becomes more important as DOE begins to retrieve and treat remote-handled transuranic wastes that generate very high radiation fields and must be handled by remote-controlled equipment. DOE is planning to ship remote-handled wastes from the Idaho Cleanup Project to the Waste Isolation Pilot Plant in 2007.

In 2006, the Board reviewed two principal deliverables of DOE's implementation plan for Recommendation 2005-1: (1) nuclear material packaging requirements and (2) a repackaging prioritization methodology. The Board found that fundamental errors in analyses and narrowing of scope had substantially precluded the intended benefits of both documents. The Board identified these errors in analysis and reasoning in letters dated April 24, 2006 and May 1, 2006. DOE's responses, provided in letters dated June 8, 2006 and July 21, 2006, were not satisfactory to the Board. Discussions between the Board and DOE resulted in a DOE letter dated July 27, 2006, rescinding several of its responses. Further discussions between the Board and DOE have resulted in substantial progress toward resolving the Board's concerns. DOE subsequently revised its implementation plan for Recommendation 2005-1 in a letter dated November 22, 2006, to reflect the delays in completing these two principal deliverables. The Board will continue to hold DOE to commitments it made to improve nuclear material packaging for protection of workers.

Deactivation and Decommissioning Operations

DOE continues to deactivate, decontaminate, and decommission many facilities at sites such as the Idaho Cleanup Project, Hanford Site, Savannah River Site, Oak Ridge National Laboratory, and the Miamisburg Closure Project. In the past, the Board has noted that operating contractors lack the expertise to plan and conduct deactivation and decommissioning work. (Examples include the Board's letters dated February 11, 2005 and February 14, 2005.) In these cases, DOE must bring in managers and workers who are familiar with the unique hazards of these activities and who understand the continually changing nature of a facility undergoing decommissioning. Specialists are needed in nuclear criticality safety, fire protection, contamination control, and remote measurement of nuclear materials in piping, vessels, and systems. The Board will continue to provide close oversight of these projects.

1. Introduction

1.1 Background

The Defense Nuclear Facilities Safety Board is an independent federal agency established by Congress in 1989. Simply stated, the Board's mandate under the Atomic Energy Act is safety oversight of nuclear weapons facilities managed by the Department of Energy. The nuclear weapons program remains a complex and hazardous operation. DOE must maintain in readiness a nuclear arsenal, dismantle surplus weapons, dispose of excess radioactive materials, maintain aging facilities, clean up surplus facilities, and construct new, complex, one-of-a-kind, high-hazard facilities for many purposes. All of these functions must be carried out in a manner that protects the public, workers, and environment.

Congress established the Board as an independent agency to provide sound technical safety oversight of DOE's defense nuclear weapons facilities and operations. For that reason, the Board is composed of respected experts in the field of nuclear safety. The Board has, in turn, assembled a permanent staff with broad experience and competence in all major aspects of safety.

The Board has established site offices at six high-priority defense nuclear sites: Pantex Plant in Texas, Los Alamos National Laboratory in New Mexico, Y-12 National Security Complex in Tennessee, Savannah River Site in South Carolina, Hanford Site in the State of Washington, and Lawrence Livermore National Laboratory in California. The site offices provide the Board with a continuous presence at these locations. At other locations, the Board maintains safety oversight by means of regular onsite reviews by members of its technical staff.

During the Board's 17 years of operation, its priorities have evolved with changes in the nuclear weapons program. The Board uses its Strategic Plan, required by the Government Performance and Results Act, to ensure that its limited resources remain focused on the most significant health and safety challenges and keep pace with shifts in those challenges from year to year. The Board's health and safety oversight activities are closely tied to goals and objectives embodied in this plan.

This Annual Report summarizes the Board's work during calendar year 2006. Sections 2, 3, 4, and 5 describe progress in the four major areas of the Board's operations: Nuclear Weapons Operations, Nuclear Materials Processing and Stabilization, Nuclear Facilities Design and Infrastructure, and Nuclear Safety Programs and Analysis. Section 6 explains the Board's interactions with the public and reports on administrative matters. Appendix A lists all recommendations cited in this report, Appendix B lists all reporting requirements imposed on DOE in 2006, and Appendix C contains a full list of the Board's 2006 correspondence.

1.2 Oversight Strategy

Maintaining an effective safety oversight program that fulfills the broad mandates of the Board's enabling legislation requires continuing reassessment of health and safety conditions throughout DOE's defense nuclear complex. The Board concentrates its resources on the most hazardous operations and complex safety issues, guided by its Strategic Plan and the following principles.

- **Oversight Role** - As an oversight but not a regulatory agency, the Board uses a variety of statutory powers to ensure adequate protection of the public and worker health and safety. While the Board is empowered to identify current and potential safety problems and to recommend solutions, DOE remains responsible for taking actions based on the Board's insights.

- **Risk-Based Oversight** - The Board's safety oversight activities are prioritized predominantly on the basis of risk to the public and workers, types and quantities of nuclear and hazardous material at hand, and hazards of the operations involved.

- **Technical Competence** - The Board has endeavored since its inception to ensure that DOE obtains and maintains the high level of technical expertise essential to the management of nuclear activities.

- **Line Management** - Primary responsibility for safety resides in DOE and contractor management. Safety oversight can reinforce but not substitute for the commitment of line management and workers to safe work planning and performance.

- **Clear Expectations** - Effective safety management demands that safety expectations be clearly defined and tailored to specific hazards. Work instructions that are clear, succinct, and relevant to the work are more likely to be embraced by workers.

- **Effective Transition Planning** - The Board's safety oversight of defense nuclear facilities is coordinated with other federal agencies and with state governments to ensure a smooth transition from deactivation and decommissioning to environmental regulation.

The Board is provided by statute with a number of tools to carry out its mission. Among these are recommendations (typically broad and comprehensive in nature), reporting requirements (focused on specific safety issues), and public hearings (used to obtain information from DOE, other expert sources, and the public at large). Since 1989 when the Board began operations, it has issued 48 formal recommendations, comprising 221 individual sub-recommendations. In that same period of time, the Board has issued 184 reporting requirement letters and held 94 public hearings.

1.3 Strategic Plan

The Board organizes its safety work by merging the broad health and safety mandate of its statute with the requirements of the Government Performance and Results Act. The Board's Strategic Plan identifies the serious hazards of handling nuclear weapons and weapons materials, and disposing of aging and surplus facilities. These hazards include:

- Tons of radioactive and toxic materials throughout the defense nuclear complex, some stored in an unstable state.

- Aging facilities that require ever-increasing maintenance and surveillance to assure safety.

- The potential for accidental releases caused by inadequate safety controls, human errors, equipment malfunctions, chemical reactions, building fires, detonations, and criticality events.

- Natural phenomena such as wildfires, earthquakes, extreme winds, floods, and lightning.

Given these hazards, safety can be assured by the adoption of a conservative engineering philosophy that hinges on reliable systems and multiple layers of protection. This concept is called "defense in depth," and it has been a precept of nuclear safety in the United States for many decades. Defense in depth is especially important with respect to the handling of high explosives in proximity to radioactive material.

The Board's Strategic Plan sets forth four general goals:

- *Nuclear Weapons Operations*: Operations that directly support the nuclear stockpile and defense nuclear research are conducted by DOE in a manner that ensures adequate protection of the health and safety of workers and the public.

- *Nuclear Materials Processing and Stabilization*: Processing, stabilizing, and disposing of hazardous nuclear materials are performed by DOE in a manner that ensures adequate protection of the health and safety of workers and the public.

- *Nuclear Facilities Design and Infrastructure*: New defense nuclear facilities and major modifications to existing facilities are designed and constructed by DOE in a manner that ensures adequate protection of the health and safety of workers and the public.

- *Nuclear Safety Programs and Analysis*: Regulations, requirements, guidance, and safety management programs adequate to protect public health and safety, including workers, are developed and implemented by DOE.

2. Nuclear Weapons Operations

2.1 Safe Conduct of Stockpile Management

Stockpile management refers to the industrial aspects of maintaining the nation's nuclear weapons stockpile. Examples of the Board's activities to improve health and safety in stockpile management are discussed in the following subsections.

2.1.1 Pantex Plant

The Pantex Plant, located near Amarillo, Texas, serves a central role in stockpile management. Operations at the site include assembly, disassembly, dismantlement, and surveillance of weapons, as well as interim storage of special nuclear material removed from retired weapons. In 2006, the Board sought health and safety improvements in weapons operations, requirements for the evaluation of weapons response to external stimuli, implementation of the special tooling program, and implementation of multi-unit operations.

Nuclear Explosive Safety. In response to a commitment made to the Board in 2005, DOE conducted a comprehensive "Top-Down Review" of its nuclear explosive safety directives to determine if existing requirements are being implemented effectively, and to propose improvements to the requirements for ensuring the safety of nuclear explosive operations. On November 2, 2006, the Assistant Deputy Administrator for Military Application and Stockpile Operations issued a corrective action plan to implement 11 of the 20 recommendations from the Top-Down Review. The Board is conducting its own review of the nuclear explosive safety process and has identified a number of additional issues to be addressed in 2007.

W88 Cell Operations. During 2006, Los Alamos National Laboratory requested that the W88 program take steps to restart cell operations to perform disassembly and inspection on a limited number of units to support a high priority, safety-related significant finding investigation. In order to meet this request in a timely manner, the Pantex Plant contractor requested a temporary exemption from the documented safety analysis requirements of 10 CFR (Code of Federal Regulations) Part 830, *Nuclear Safety Management*, subpart B. In a letter dated August 9, 2006, the Board requested that the Deputy Administrator for Defense Programs consider compensatory measures for the proposed disassembly and inspection operations. In addition, the Board requested justification for proposed rebuild operations and any additional operations performed beyond the three units identified by Los Alamos, and that NA-10 consider the impact of the proposed operations on the timely implementation of a Seamless Safety for the 21st Century process for W88 cell operations. The Deputy Administrator provided the requested information to the Board and issued a temporary exemption limited to the disassembly and inspection and rebuild of three specific units. Direct observation of sensitive operations by laboratory experts was instituted as an additional safety measure.

To ensure a safe approach to restart of W88 cell operations, the Board observed the limited scope nuclear explosive safety study, DOE's readiness assessment, and disassembly of the first W88 unit, which was in process at the end of 2006. The Board is continuing to press DOE to develop a firm schedule for implementing an SS-21 process for W88 operations.

Recommendation 98-2. NNSA management continued to provide the Board with regular briefings on the status of commitments in the implementation plan for Recommendation 98-2. DOE completed the commitment to implement an SS-21 process for a weapons program with insensitive main charge explosives by implementing such a process for the B61, B83, and W87 programs in 2006.

In May 2006, DOE issued a revision to *Hazard Analysis Reports for Nuclear Explosive Operations* (DOE-STD-3016), which was intended in part to close the commitment in the implementation plan for Recommendation 98-2 to provide further guidance on expectations for the development and documentation of weapons response information. In a letter dated August 16, 2006, the Board provided comments to DOE on the revision to the standard. DOE briefed the Board on its responses to the Board's comments and described its planned approach to ensuring that hazard analysis reports and weapons response information were adequate. However, follow-up reviews by the Board found that there was still no clear plan for implementing improved processes for developing and documenting weapons response information. Therefore, in a letter dated December 15, 2006, the Board requested that the Final Assessment Report required by the implementation plan for Recommendation 98-2 include an explicit description of DOE's plans and criteria for review and approval of the design agencies' processes for expert elicitation, expert judgment, and peer review as required by DOE-STD-3016.

Cell Gap Analysis. The Board evaluated calculations of leakage through gaps in cells. These calculations were performed to better understand the consequences of potential accidents at the Pantex Plant. Based on these calculations, leakage through cell gaps does not appear to be an issue for accident scenarios involving single-unit operations. However, there is still a concern that accident consequences for multi-unit operations involving certain systems in certain facilities could challenge the evaluation guidelines. DOE will perform additional analyses to provide assurance that the evaluation guidelines will not be challenged for multi-unit operations.

Electrostatic Discharge. The Board evaluated efforts by DOE and the weapons design agencies to characterize potential electrostatic discharge effects and the response of sensitive components to them. Progress has been made in defining the environments and the associated hazards; however, the Board has identified the need for additional clarification with respect to furniture (e.g., tooling and equipment), capacitive coupling between the insulting objects and other nearby charged objects, the assumption of electrical isolation of tools within the established standoff boundary, and resonance conditions and effects.

Special Tooling Program. In a letter dated December 15, 2004, the Board expressed concern that continuing weaknesses in the Special Tooling Program could have an adverse impact on the safety of nuclear explosive operations that rely on specially designed tools to eliminate or minimize hazards. In response, DOE conducted a comprehensive, independent review of tooling program deficiencies and committed to implementing corrective actions. The Board reviewed the program in March 2006 and determined that the safety and efficiency of nuclear explosive operations had been enhanced.

Seamless Safety for the 21st Century. In 2006, the Board evaluated the start-up of the Seamless Safety processes for the W87 and B61 Disassembly & Inspection and Rebuild Programs and the B83 Disassembly & Inspection Program. The enhanced processes utilize

upgraded procedures, redesigned tooling, and fewer handling and lifting steps. These improvements make the operations significantly safer and more efficient than their predecessors.

Safety of Dismantlement Operations. The Board evaluated process development and execution of the W56 dismantlement campaign at Pantex. The Board urged DOE to ensure that laboratory expertise, both active and retired, was applied to resolve technical challenges that arose to help ensure the safe and successful completion of the dismantlement campaign. Dismantlement of all W56 war reserve units was safely completed in June 2006.

The Board continued to evaluate DOE's plans to dismantle an older weapons system not protected by modern safety controls. The Board expressed concern to DOE regarding proposed disassembly activities at non-DOE facilities that did not have adequate safety programs and systems. DOE no longer plans to use such facilities; dismantlement operations are now planned for Pantex facilities.

Conduct of Operations. In response to a Board letter issued in May 2005 identifying deficiencies in the conduct of nuclear explosive operations at Pantex, DOE initiated efforts to address the cause of the deficiencies and to develop both near- and long-term plans to improve the conduct of operations. After a follow-up review, the Board issued a letter to DOE in March 2006, re-emphasizing the importance of a consistently high degree of formality in the conduct of nuclear explosive operations, and favorably noting the extensive involvement of senior contractor management in developing and implementing improvements in conduct of operations at Pantex. As proposed improvements are implemented and the process matures, the Board expects to see continued improvement in this area. The Board is continuing to evaluate improvements in the formality of work through daily operational oversight provided by its site representatives.

Multi-Unit Operations. The Board is evaluating the safety implications of the implementation of multi-unit nuclear explosive operations at Pantex, which are being pursued in support of increasing throughput. In response to the Board's observations, Pantex is taking a more comprehensive approach to evaluating the implementation of multi-unit operations, including analyzing human factors considerations. In addition, the Board has urged Pantex to become more closely involved with studies being performed by the design agencies that will aid in evaluating the increase in risk associated with performing multi-unit operations.

Technical Safety Requirement Implementation. In October 2006, the contractor at Pantex completed the implementation of more than 200 Technical Safety Requirements. Continued engagement by the Board during this three-year effort resulted in the implementation of some new controls and improved the overall quality of the safety basis documents. DOE has so far verified implementation of 138 of these controls. The Board will continue to monitor implementation of Technical Safety Requirements.

2.1.2 Y-12 National Security Complex

Y-12 National Security Complex is a manufacturing facility located in Oak Ridge, Tennessee. Stockpile management activities at Y-12 include production, maintenance, refurbishment, dismantlement, evaluation, and storage of certain components of nuclear weapons. Production activities include manufacture or re-manufacture of unique nuclear weapons components. The Board's most recent efforts to improve safety at Y-12 concentrated on highly enriched uranium processing, conduct of operations, fire protection, and the safety of several new or modified processing capabilities.

9212 Complex Seismic Deficiencies. The 9212 Complex at Y-12 is a collection of structures built between 1947 and 1958 for processing highly enriched uranium. While updating the complex's safety basis in 2004, DOE noted numerous seismic deficiencies, including missing bolts, missing or structurally inadequate braces, inadequate beam supports, and designs that are deficient when measured by current design requirements for nuclear facilities. In addition to the facility structure, internal systems are subject to seismic failure, including tall glass columns and sight glasses, can restraints, storage racks, and storage tanks.

In response to Board letters issued in April and November 2005, DOE agreed to perform maintenance-related fixes and other practical facility modifications to the 9212 Complex and to perform a review to identify other actions needed to support safe operations. DOE provided the results of this review to the Board in November 2006. The reviewers concluded that the most practical approach to improving the safety posture of the 9212 Complex is to reduce the inventory of nuclear materials in the facility. DOE plans to increase maintenance funding and pursue other facility infrastructure improvements while working to accomplish that inventory reduction.

DOE's response also indicated that the main long term action necessary to support safe processing of highly enriched uranium at Y-12 is to construct the planned Uranium Processing Facility, which will be designed to efficiently meet modern safety and security requirements. By year's end, however, DOE had not defined the point at which more aggressive remedies would be required to keep the 9212 Complex operational, should this facility be delayed, and what those remedies would entail. The Board is continuing discussions with DOE on this matter.

9212 Complex Safety Analysis. The Board reviewed a draft version of the documented safety analysis for the 9212 Complex, the final Y-12 facility to implement a safety basis in accordance with 10 CFR Part 830. The Board noted weaknesses associated with the calculation of off-site consequences that resulted in improper classification of safety systems, including certain fire protection systems. The Board communicated these issues to DOE in a letter in February 2006. In response, DOE upgraded the classification of key fire protection systems to safety-class. Discussions continue with DOE on the safety analysis methodology for Y-12 facilities.

Conduct of Operations. The Board had noted overall improvement in the proper conduct and formality of nuclear operations at Y-12 during recent years. However, following several operational errors and events at this facility, the Board urged DOE to consider special action to achieve consistent, disciplined operations in Y-12 nuclear facilities. Examples included

failure to adhere to criticality safety requirements, an inadvertent hazardous gas release, and conduct of a nuclear operation without proper authorization. DOE evaluated the concerns and concluded that the events were generally caused by lack of adherence to procedures or non-conservative decisions by operations personnel upon encountering an unanticipated condition. DOE developed a plan in December 2006 that outlines actions to address these causes. With proper implementation, the plan should improve conduct of operations at Y-12.

Uranium Holdup Survey Program. The Y-12 Uranium Holdup Survey Program is used to monitor accumulations of enriched uranium in process systems to protect against an inadvertent criticality. DOE developed a corrective action plan to address issues identified by both DOE's and the Board's assessment in 2005 and for operational events in 2006 where the program failed to identify fissile material accumulations. During 2006, DOE made progress on equipment upgrades and in improving the formality in identifying and responding to high accumulations of enriched uranium. DOE also implemented a new approach to evaluate uranium holdup using design features, periodic cleanout, and routine hold-up monitoring in combination for all uranium process operations that rely on the holdup program.

Criticality Safety. In April, the Uranium Holdup Survey Program indicated a large holdup in a filter in a system providing vacuum to uranium casting furnaces. Initial criticality safety assessments concluded that lack of moderation was the only remaining contingency precluding a criticality accident. Subsequently, a moderator (oil) was observed to have leaked from the filter housing. This represented a serious safety concern. The Board provided input regarding assay procedures, criticality calculations, and the approach to filter cleanout for DOE's consideration in developing a recovery plan. The Board's input resulted in a more demonstrably safe recovery operation.

Fire Protection. In response to Board correspondence in 2002, DOE developed a ten-year comprehensive improvement plan for fire protection at Y-12. Significant improvements were subsequently made in many facets of fire protection, such as maintenance of systems, analysis of fire hazards, and inspection of fire barriers. Progress stalled in 2006 due to a cut in funding for the project. The Board queried DOE on plans for completing the project. DOE committed to provide a revised plan in early 2007.

Quality Assurance. Because of quality assurance problems found during construction of the Highly Enriched Uranium Materials Facility, and other site-wide quality assurance problems identified in early 2006, DOE developed a site-wide corrective action plan. The Board reviewed the plan and provided specific comments. Based on this feedback, DOE chartered a local steering group to review the effectiveness of completed corrective actions, and the contractor provided corporate-level resources to conduct a review of corrective action progress.

Conduct of Engineering. In 2005, Y-12 personnel discovered that the design of a new vessel installed for blending enriched uranium materials would not preclude a criticality accident in a water intrusion scenario. A design change was necessary to correct this deficiency. Subsequently, the Board found that a planned Y-12 investigation of this engineering deficiency had not been completed. In response to an inquiry by the Board, Y-12 completed the investigation and developed corrective actions. The Board found that the corrective actions did not fully address the lack of an appropriate design review of the new installation. At year's end,

Y-12 was evaluating its engineering protocols regarding performance of design reviews for the installation of new process equipment and systems.

2.1.3 Savannah River Site Tritium Operations

Tritium Extraction Facility. The Tritium Extraction Facility will be used to extract tritium from target rods irradiated in commercial light water reactors. The extracted tritium will be used to replenish tritium reserves for the nation's nuclear weapons stockpile. During 2006, the Board reviewed startup preparations, observed readiness reviews conducted by the contractor and by DOE, and as the year ended, monitored the startup of nuclear operations. During the readiness reviews, the contractor demonstrated the ability to safely perform extraction evolutions, but did not demonstrate the ability to routinely conduct these evolutions without frequent work interruptions or compensatory actions to address equipment reliability issues. Frequent problems were encountered with the ventilation system, the Tritium Rod Preparation Module, various cranes, several electronic procedures, and the Tritium Air Monitoring System. While these problems were handled correctly, the Board encouraged the Savannah River Site to take full advantage of site programs for System Health Reports and performance monitoring, because repeated equipment problems can lead to complacency (i.e., deficient conditions become viewed as normal) and other conduct of operations problems.

2.1.4 Nuclear Material Packaging

Recommendation 2005-1. The Board issued Recommendation 2005-1 to provide more reliable protection for workers from the hazards associated with storage and handling of nuclear materials. The recommendation stated, and DOE accepted, the fundamental principle that this would be achieved by issuing a requirement that "nuclear material packaging meet technically justified criteria for safe storage and handling." In 2006, the Board reviewed two principal deliverables of DOE's implementation plan for Recommendation 2005-1: (1) a methodology for assigning priorities to repackaging operations, and (2) a manual for these operations.

The methodology was issued by DOE on March 31, 2006. In a letter dated April 24, 2006, the Board pointed out errors in analysis and reasoning. DOE's response, provided in a letter dated July 21, 2006, was not satisfactory to the Board and was partially rescinded by DOE in a letter dated July 27, 2006, pending further discussions between DOE and the Board. DOE subsequently revised its implementation plan for Recommendation 2005-1 in a letter dated November 22, 2006, noting that the methodology was being further evaluated based on comments from the Board and would be revised and reissued, if warranted, by February 28, 2007.

In its implementation plan, DOE committed to issuing packaging requirements for "materials that are stored outside of an approved engineered contamination confinement barrier, such as a glovebox or packages meeting DOE-STD-3013 and/or DOE-STD-3028." These requirements are to be issued as a new DOE *Nuclear Material Packaging Manual*, a draft version of which was sent to Board for comment on March 31, 2006. In a letter to DOE dated May 1, 2006, the Board identified deficiencies that would undermine the safety benefits of the manual if not appropriately resolved, such as wording that would allow the sites to exclude many hazardous nuclear materials from the scope of the manual without ensuring that adequately

engineered protection would be provided for workers. DOE's response, provided in a letter dated June 8, 2006, was not satisfactory to the Board. Further discussions between the Board and DOE have resulted in substantial progress toward resolving the Board's comments on the draft packaging manual. DOE's revised implementation plan for Recommendation 2005-1 commits to submitting the packaging and storage requirements document into DOE's Directives System by February 28, 2007. The Board will continue to ensure that DOE meets its commitment to improve nuclear material packaging for protection of its workers.

2.2 Safe Conduct of Stockpile Stewardship

Stockpile stewardship refers to activities carried out in the absence of underground nuclear weapons testing to ensure confidence in the safety, security, and reliability of nuclear weapons in the nation's stockpile. Stockpile stewardship includes using past nuclear test data in combination with future non-weapons test data and aggressive application of computer modeling, experimental facilities, and simulations. Safety aspects of activities at the major sites engaged in stockpile stewardship are discussed in the following subsections.

2.2.1 Los Alamos National Laboratory

Los Alamos National Laboratory, located in New Mexico, is the DOE weapons laboratory with the largest number of defense nuclear facilities and weapons-related activities. In 2006, a new contracting structure was put in place for management of the laboratory. The Board focused its attention on institutional corrective actions, federal oversight, active confinement ventilation, nuclear criticality safety, fire protection, and transuranic waste operations.

Institutional Corrective Actions. The Board spent considerable effort, including holding a public hearing on March 22, 2006, reviewing DOE's institutional corrective action programs and heightening awareness of the need to maintain these programs through contract transition. Corrective actions focus on key areas including safety, quality assurance, software quality assurance, conduct of engineering, safety bases, conduct of operations, environmental risk management, and training. The Board has urged DOE to adequately fund corrective action plans.

Federal Oversight. On October 1, 2006, DOE began a two-year pilot of a new federal oversight model at the Los Alamos Site Office. The pilot increases the federal presence in nuclear and high hazard facilities and relies on the contractor's assurance systems to monitor less hazardous operations. The Board objected to the concept of the pilot and raised specific concerns including the lack of compensatory measures in oversight for the period of time it takes for the contractor's assurance system to reach full effectiveness and maturity; the absence of federal oversight of radiological facilities under the pilot; and significant weaknesses in the technical capability of the federal workforce.

Confinement Ventilation at the Plutonium Facility. The current safety basis for the Plutonium Facility relies on a passive confinement strategy that does not credit active confinement ventilation for protecting the public from postulated accidents. In response to issues raised by the Board, a comprehensive set of airflow calculations was performed to estimate

potential releases under accident conditions. The analysis demonstrated that the passive confinement strategy was inadequate, and the laboratory developed preliminary compensatory measures and alternatives for the confinement strategy. Under the implementation plan for the Board's Recommendation 2004-2, confinement ventilation at this facility is now being assessed on a high priority basis with an accelerated schedule. The Board will continue to review and provide feedback to DOE.

Fire Protection. On May 15, 2006, the Board received DOE's response to issues previously identified by the Board regarding the need to define a multi-year strategy for timely resolution of all fire protection deficiencies and achievement of site-wide improvements. Issues requiring resolution included incomplete documentation and delays in the completion of inspections, tests, and maintenance; untimely implementation of fire hazard analysis recommendations; no formal plan to address the Baseline Needs Assessment for fire and emergency services; no long-term contract for fire and emergency services with Los Alamos County; and fire alarm systems in several defense nuclear facilities still requiring upgrades. DOE is currently updating the strategy to reflect additional scope and funding adjustments. Overall, the Board has succeeded in increasing management attention to the fire protection problems, but these problems will take additional analysis, time, and attention to fully resolve.

Transuranic Waste Operations. The Board has been closely following efforts to safely dispose of the laboratory's large inventory of transuranic waste, which is packaged in drums and other containers within several hundred meters of the site boundary. Some of the highest consequence accidents postulated at the laboratory involve this transuranic waste inventory. The Board has urged DOE to expeditiously develop a viable disposition pathway for this waste.

Support of Nuclear Weapons Operations at Pantex. In August 2006, the Board assessed the laboratory's protocols for support of operations at the Pantex Plant. With respect to elements of the Board's Recommendation 2002-2, the Board found a lack of succession planning for weapons system experts. The Board also observed a lack of progress toward developing a formalized expert elicitation (or expert judgment) process for review of weapons response information, which in part led to the Board's December 15, 2006, letter to DOE requesting its plans for the review and approval of these essential design agency processes.

Power Grid Infrastructure Upgrade Project. In reports dated May 5, 1995, December 5, 1996 and September 22, 1999, the Board noted that a single-point failure vulnerability existed in the high-voltage transmission lines that provide off-site power to the laboratory. A failure at this single point, where aerial transmission lines from each of the independent feeds crossed, could have isolated the laboratory from off-site power for an extended time until repairs could be performed. In response, DOE initiated a project to eliminate this single-point failure vulnerability by providing an independent power feed to the existing Western Tech Area substation. Construction of the independent power feed was completed in 2006, and overall project completion is scheduled for spring 2007.

2.2.2 Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory, located 45 miles southeast of San Francisco, California, is a nuclear weapons research and development laboratory. It provides technical

expertise to support stockpile stewardship and management, including consulting on the surveillance and dismantlement of nuclear weapons. Most defense nuclear activities are conducted in the Superblock complex, which includes the Plutonium Facility and the Tritium Facility. During 2006, the Board conducted reviews of resumption of operations in the Plutonium Facility, configuration management of vital safety systems at the Superblock facilities, criticality safety, fire protection, and conduct of operations.

Resumption of Plutonium Facility Operations. In January 2005, DOE's Office of Independent Oversight and Performance Assurance issued a report identifying serious deficiencies in the administrative control programs mandated by the Technical Safety Requirements for the Plutonium Facility (including the configuration management program), as well as deficiencies in the supporting analyses for safety systems. Because of these findings, the laboratory suspended programmatic operations in the Plutonium Facility. The Board issued a letter to DOE on March 8, 2005, cautioning against resuming operations until the assessment report's findings had been adequately studied and requesting a report on planned corrective actions. On October 11, 2005, DOE authorized the resumption of limited operations in the Plutonium Facility using a process for achieving and verifying readiness found generally acceptable by the Board. In April 2006, the Board observed the laboratory's readiness assessment to remove the remaining compensatory measures and return to normal operations, and determined that operations could safely resume. On May 23, 2006, DOE authorized the laboratory to resume normal operations.

Configuration Management. In a November 2004 letter, the Board identified the apparent lack of configuration management of vital safety systems at Lawrence Livermore facilities. DOE responded on January 4, 2005, agreeing that prompt action needed to be taken to review the configuration and condition of all vital safety systems in defense nuclear facilities at the laboratory. During 2005, DOE completed evaluations of the application of configuration management for the vital safety systems at Lawrence Livermore defense nuclear facilities and developed plans to establish the needed configuration management program. During 2006, the laboratory established procedures and processes to maintain an interim configuration management system. The Board reviewed this system and found it to be reasonably adequate to support operations while a more durable institutionalized program is developed and implemented.

Criticality Safety. In response to the Board's Recommendation 97-2, DOE established an interim capability at the laboratory in 2006 for hands-on criticality safety training that meets DOE- STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification*. Training classes previously held at Los Alamos National Laboratory had been halted pending the establishment of a suitable location. Lawrence Livermore conducted the first hands-on training class in September 2006.

2.2.3 Nevada Test Site

The Nevada Test Site is located in southern Nevada, about 75 miles northwest of Las Vegas. Stockpile activities at the Test Site include test readiness preparations, planning for the disposition of damaged nuclear weapons, and subcritical experiments. Underground testing of nuclear weapons is no longer being conducted; however, the site is maintained in a state of

readiness should national security requirements demand the resumption of underground testing. The Board seeks to ensure that if testing is resumed, it will be done safely. During 2006, the Board focused its attention on the Device Assembly Facility, test readiness posture, capability to dispose of a damaged nuclear weapon, subcritical experiments, and conduct of transuranic waste operations.

Device Assembly Facility. The Device Assembly Facility is a key structure at the Nevada Test Site, intended to house diverse operations including nuclear explosive operations and criticality experiments. In 2004, the Board requested that DOE assess the Device Assembly Facility's safety systems and management programs. DOE attempted to respond by using the site office's assessment program, but this was ineffective in delivering a comprehensive assessment. The Board wrote to DOE again on November 28, 2005, requesting that more aggressive action be taken with respect to the assessment of the safety systems and management programs needed to ensure that the Device Assembly Facility is ready for planned increases in the scope of work. In response, DOE developed assessment plans for each vital safety system and safety management program and began assessments in 2006. Assessments and corrective actions will continue in 2007.

The Board evaluated the physical condition of the Device Assembly Facility and found extensive rainwater leakage and extensive cracking in the facility's walls and floors. The Board advised DOE in a letter dated March 18, 2005, that an immediate and thorough evaluation was needed. DOE has taken suitable remediation actions, but the Board is still concerned that the extensive cracking might have been the result of poor construction practices that adversely affected the concrete's in situ strength. The Board has advised DOE that it would be prudent to evaluate the in situ concrete compressive strength using non-destructive investigation techniques, assess the potential for long-term rebar corrosion, and assure confinement and leak tightness of the bays and cells. However, DOE has declined to perform in situ testing of the concrete. The Board is considering further action on this subject.

Damaged Weapons. The Board has consistently highlighted to DOE the need to develop the programs and infrastructure necessary to safely dispose of a damaged nuclear weapon or improvised nuclear device. G Tunnel at Nevada Test Site is the location DOE has selected for these activities. In a March 28, 2005 letter to DOE, the Board noted the slow progress in defining and executing an action plan for addressing known problems with G Tunnel. The Board subsequently determined that DOE no longer had a clear plan for meeting this programmatic need. In a June 19, 2006 letter to DOE, the Board requested that DOE explain the required state of facility readiness and its plans for safety improvements, because it did not appear the mission and hazards had changed. DOE responded with a new statement of policy for the disposition mission at the Test Site, including a new scope of operations at G Tunnel. In follow-up discussions, DOE stated that a revised safety analysis is being developed that will identify safety controls and upgrades appropriate for the new scope of operations. The Board expects the new analysis to be available for review in 2007.

Subcritical Experiments. The Board reviewed preparations for subcritical experiments at the Test Site and identified inadequate nuclear safety management programs. DOE made improvements for the UNICORN experiment in 2006 in areas such as safety basis reviews, implementation of controls, and readiness reviews. As a result, UNICORN had a more complete

documented safety analysis and thorough verification of readiness. The Board has stressed to DOE that it is essential to carry the improved practices and formality forward for future subcritical experiments and as part of maintaining nuclear test readiness.

Safety Basis Reviews. The Board continued to review the safety bases for nuclear facilities and activities, including the Device Assembly Facility, Criticality Experiments Facility Project, U1a Complex, Radioactive Waste Management Complex, G Tunnel, subcritical experiments, and onsite transportation. Although the safety bases are improving substantially, in 2006 the Board identified deficiencies in submitted documented safety analyses and technical safety requirements, classification of a facility, and in a Transportation Safety Document. Several iterations of DOE review and document revision are needed to develop and implement adequate safety bases.

Lightning Protection and Electrical Systems. In 2003 and 2005, the Board noted deficiencies in lightning protection and in electrical systems. In the past three years, DOE has made gradual improvements. In 2006, a site-wide directive for the lightning protection program was completed, as well as lightning protection studies. As a result, the Test Site now has a technical basis to identify appropriate controls for lightning protection for hazardous operations and has implemented a site-wide lightning protection program and controls. Remaining electrical safety issues include oil-insulated transformers at the Device Assembly Facility, an antiquated ventilation system in G Tunnel, and the need to demonstrate the adequacy of the Faraday cage in the operations alcove in G Tunnel.

2.2.4 Sandia National Laboratories

Sandia National Laboratories are located in Albuquerque, New Mexico, and Livermore, California. Major defense nuclear facilities at Sandia, most of which are located in Technical Area V at the New Mexico site, include the Annular Core Research Reactor, Auxiliary Hot Cell Facility, Gamma Irradiation Facility, and Sandia Pulsed Reactor Facility. In September 2004, the Board issued a letter questioning the adequacy of safety bases at Sandia. Subsequently, the Board issued a letter asking for a schedule of actions to be taken to ensure that integrated safety management is fully implemented at Sandia. Follow-up reviews performed by the Board during 2006 found that DOE has continued to make progress toward completing the corrective actions for the identified deficiencies.

2.2.5 Research and Development for Explosives Safety

The Board reviewed research and development on high explosives and weapon detonator safety for Pantex Plant operations, as conducted at both Los Alamos and Lawrence Livermore National Laboratories. The laboratories are testing detonators for electrostatic discharge hazards and reviewing the safety of operations with certain detonators at Pantex. One very positive outcome has been the installation of special static dissipative flooring in certain Pantex Plant facilities as an engineered safety control to mitigate electrostatic discharge concerns for a weapons system. The Board also reviewed work at Los Alamos and Lawrence Livermore to determine the effects of aging on weapon explosives. Low-velocity impact and mechanical strength testing are being used to model and predict the properties of aged explosives. The Board observed from these data that a certain aged explosive was safe for planned operations.

DOE briefed the Board on the Enhanced Surveillance Campaign in December 2006. This campaign has funded significant research and development on the effects of aging on numerous stockpile components with safety implications. Recent accomplishments include research and development support for stockpile transformation and infrastructure, significant finding investigations, annual assessments of weapons systems, and new diagnostics for stockpile surveillance.

3. Nuclear Materials Processing and Stabilization

3.1 Stabilization and Storage of Remnant Materials

3.1.1 Complex-Wide Program

Nuclear Material Stabilization. The Board provided significant oversight of DOE efforts to improve the safety posture of remnant nuclear materials throughout the DOE complex. HB-Line operators at the Savannah River Site stabilized the final quantities of neptunium solutions included in the scope of Recommendation 2000-1. This activity marks the completion of all commitments under this recommendation at the Savannah River Site. However, the Board continues to monitor the safety of unstabilized materials still in storage at the Hanford Site and the Los Alamos National Laboratory. Details of these activities are provided in later sections of this report.

Nuclear Material Consolidation, Storage, and Disposition. For several years, DOE has attempted to develop a coordinated plan for the consolidation and disposition of nuclear materials that are excess to national security needs. Some activities have proceeded on an individual basis, but an integrated, complex-wide plan does not yet exist. In March 2005, the Secretary of Energy chartered the Nuclear Material Disposition and Consolidation Coordination Committee to develop such a plan. This committee continues to assemble parts of the plan, but progress has been slow. The Board meets regularly with the chairman of the committee and provides feedback on potential safety issues.

This year, the committee approved an implementation plan for the consolidation of plutonium-239 materials from several DOE sites to one location. However, the plan is considered predecisional until DOE submits its fiscal year 2008 budget request to Congress. If implemented, this plan will represent a significant step forward in material consolidation. The plutonium-239 plan is the first of eight plans to be approved. The second plan, addressing the consolidation and disposition of uranium-233 materials, is in draft form. The other plans, addressing the consolidation of plutonium-238 and removal of excess materials from specific DOE sites remain at the conceptual planning stage.

3.1.2 Plutonium

Plutonium Stabilization, Los Alamos National Laboratory. Operators at the Los Alamos National Laboratory are stabilizing or repackaging excess nuclear materials stored in thousands of containers on site. The laboratory continues to make progress in risk reduction by repackaging materials into more robust containers and intends to chemically stabilize these materials at a later date when aqueous chemistry capability is fully restored. The materials include metals, residues, and oxides of both weapons grade and non-weapons grade plutonium. Many of these items are stored in containers not suitable for long-term storage, and therefore, continue to warrant stabilization or repackaging on a priority basis. The Board continues to closely monitor the storage conditions and stabilization efforts at the Los Alamos National Laboratory.

Adequacy of Plutonium Storage at the Savannah River Site. In 2006 the Board issued its third annual report to Congress on plutonium storage at DOE's Savannah River Site. DOE completed all but one of the actions required to improve storage conditions at the site, including removing combustible materials to improve the fire protection posture. The unfinished task (suggested by the Board) is to upgrade the fire protection system in the K-Area Materials Storage Facility. While DOE has planned to complete this activity, it is unclear whether funding will be available to do the work in fiscal year 2007.

3.1.3 Uranium

Oak Ridge National Laboratory. The Board began its design review of the rebaselined Uranium-233 Downblending and Disposition Project in Building 3019 at Oak Ridge National Laboratory. Following direction from Congress, DOE will continue the primary mission of downblending the material for disposition but will no longer extract thorium-229 for medical use. Current plans call for most of the downblended material to be disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste, with the remainder going to the Nevada Test Site. The project design is about 90 percent complete. Building 3019 equipment removal and facility modifications required prior to project construction will not begin until Critical Decision-3A approval. The Board reviewed the revised preliminary documented safety analysis to support Critical Decision-2/3A and advised DOE of deficiencies in fire protection controls, ventilation and confinement, and administrative controls. The Board will provide oversight to ensure that adequate safety controls are provided for this project.

3.1.4 Neptunium

Oxide Production and Storage. The Board assessed the adequacy of the actions taken by DOE to develop controls to ensure the purity of neptunium oxide at the HB-Line facility at the Savannah River Site. Subsequent to the Board's inquiries, analysis of archived samples revealed higher moisture content than anticipated. The presence of elevated levels of moisture or other contaminants could lead to container pressurization, as well as concerns over flammability and corrosion during storage. The suspect containers were restabilized, and additional process controls and verification sampling have been implemented. The Board found that the enhanced process controls, moisture sampling, and periodic impurity analysis provide adequate assurance of product quality for parameters that could impact safe storage. DOE plans to store the neptunium oxide at the Idaho National Laboratory and use it as feed to support the production of plutonium-238 for use in radioisotope power systems.

Safe Storage at the Idaho National Laboratory. The Board continues to monitor the storage of neptunium at the Materials and Fuels Complex at the Idaho National Laboratory. The Board reviewed the neptunium storage plans and provided feedback to DOE regarding the adequacy of the storage plans. As a result, DOE developed a new surveillance and maintenance plan for this activity. DOE also continues the preparation of a Final Environmental Impact Statement for the consolidation of plutonium-238 activities from across the complex to the Idaho National Laboratory.

3.2 Stabilization of Spent Nuclear Fuel

3.2.1 Hanford Site

Nearly 50 cubic meters of radioactive sludge, including the corrosion products of spent nuclear fuel, still reside in the K-East and K-West Basins at the Hanford Site. This sludge is the only material at Hanford that remains to be stabilized under the Recommendation 2000-1 program. The project warrants some urgency because the K-Basins are degrading and the K-East Basin is known to have leaked to the underlying soil. At the Board's insistence, DOE developed a new implementation plan for Recommendation 2000-1 based on a formal risk assessment process and more realistic assumptions. DOE issued the new implementation plan on November 28, 2005. DOE completed the consolidation of bulk sludge, the first milestone in the revised plan, on schedule. DOE also prepared and completed a rigorous readiness review process for the startup of the system to transfer sludge between the basins. While DOE demonstrated adequate procedures and operations, several equipment problems hampered operations after start-up. Many of these problems required design changes and equipment modifications, and this is an area the Board intends to follow closely.

The development of the system to treat sludge and package it for disposal has not had similar success. DOE authorized procurement at the contractor's discretion. The Board found that the incorporation of safety into design was behind schedule and posed an increasing risk to the project. DOE conducted an independent review of this situation and rescinded the contractor's procurement authority. DOE also considered a proposal to accelerate the closure of the Hanford K-Area by transferring sludge to the T Plant at Hanford for storage and treatment. The Board concluded that the proposal represented a change in the project baseline without a supporting conceptual design or preliminary hazards analysis. DOE reached a similar conclusion and determined that the lack of this information posed risks that did not justify the change in approach. The Board plans to continue its close oversight of this project.

3.2.2 National Spent Nuclear Fuel Program

The Board monitored DOE's efforts to plan for spent fuel packaging and storage. DOE plans to ship aluminum plate fuel from the Idaho Cleanup Project to the Savannah River Site for reprocessing in H-Canyon beginning in 2010. DOE plans to ship its stainless steel and Zircaloy clad fuel from the Savannah River Site to the Idaho Cleanup Project for packaging and storage pending shipment to the geological repository for disposal. These decisions were proposed at a national program strategy meeting in July 2006 followed by an Energy Systems Acquisition Advisory Board meeting, which approved the decision. The decision will require an amendment to the Record of Decision removing melt-and-dilute as the preferred method of handling aluminum plate fuel. The need for a packaging and shipping facility at Idaho was acknowledged. Two alternatives being considered are a dry storage option previously designed under a privatization contract and licensed by the Nuclear Regulatory Commission, and a direct packaging option proposed by the current contractor at the Idaho Cleanup Project. An independent cost evaluation team will evaluate the options and report by spring 2007. DOE plans to ship spent fuel from the Fast Flux Test Facility at Hanford to the Idaho Cleanup Project in 2007. The Board reviewed the safety of spent fuel storage at the Idaho Cleanup Project and found the facilities and systems adequate to protect worker and public safety.

3.3 Waste Management

3.3.1 High-Level Waste

Hanford Tank Farms

Tank Integrity. The high-level waste storage tanks at both the Hanford and Savannah River Sites contain millions of gallons of radioactive waste that DOE plans to vitrify and put into long term storage. Current forecasts are for continued use of these tanks for storage of the radioactive waste until about 2040. Corrosion controls are in place to extend the lives of these tanks, and in general, these controls are working reasonably well. However, over the years, there have been anomalous occurrences of pitting, crevice corrosion, and cracking in the tank walls. These occurrences have caused the Board to encourage DOE to conduct fundamental studies to better understand the ongoing corrosion mechanisms and improve corrosion controls to provide greater assurance that the tanks will not develop leaks during their service lives. DOE has responded positively. Activities in 2006 regarding tank chemistry and corrosion are noted below.

The Board questioned DOE's plans to change chemistry controls used to mitigate corrosion in tanks at Hanford. DOE responded by establishing a corrosion testing program to determine optimum waste chemistry limits for maintaining tank integrity. The first phase of this program studied the effect of pH on corrosion. The results showed the pH could as be as low as pH 10 without significantly increasing corrosion. To confirm the laboratory results, a corrosion probe has been installed in double-shell tank AN-107 to continuously monitor in-tank corrosion.

In response to the Board's letter of June 1, 2005, citing unusual corrosion observations in the vapor space of waste storage tanks at both the Hanford and Savannah River Sites, an expert panel workshop was held at Hanford. The expert panel identified several mechanisms by which corrosive species could concentrate on tank walls. A series of laboratory experiments to evaluate these mechanisms will be conducted during 2007.

Savannah River Site

High-Level Waste Management. The Board continued to monitor the high-level waste system at the Savannah River Site. DOE is faced with many challenges while balancing the priorities of safe storage of high-level waste, retrieval and treatment of the waste, and support for facilities that depend on the waste system to remain operational. The Board reviewed DOE's three-pronged strategy to remove and process the low-activity portion of wastes in the high-level waste system. The first step includes operation of the Deliquification, Dissolution, and Adjustment process, a small-scale waste treatment capability that removes low-activity liquid waste from the tanks, thereby allowing greater flexibility in many aspects of tank farm operations. Steps two and three include the design, construction, and testing of the Actinide Removal Process and the Modular Caustic Side Solvent Extraction Unit (pilot-scale waste processing facilities), which will operate until the Salt Waste Processing Facility comes on line.

DOE completed the construction of the pilot-scale waste processing facilities. Low-level radioactive waste operations are expected to commence in fiscal year 2008. The Board also reviewed the safety of the design of the Salt Waste Processing Facility. Based on delays in

permitting and regulatory activities, the step one process has been delayed but is expected to start up soon. DOE plans to update and reissue its high-level waste planning documents (i.e., Disposition Processing Plan and System Plan) to reflect these delays, and the Board plans to review these documents.

Several of the original problems that led the Board to issue Recommendation 2001-1 continue to affect the Savannah River Site. These problems include limited tank space in high-level waste tanks, delays in waste processing, mixed evaporator performance, and the fact that one of the former In-Tank Precipitation tanks (Tank 48) has remained out of service for eight years after the suspension of a failed precipitation process.

The Board believes that substantial progress must be made in 2007 or the lack of tank space will begin to jeopardize important operations such as those at the H Canyon and the Defense Waste Processing Facility. The Board continues to provide oversight of these high-level waste systems.

Hydrogen Gas in Process Systems. Last year, the Board began reviewing the risks of hydrogen accumulation in the piping and equipment at the Defense Waste Processing Facility. The concern was that a hydrogen explosion could rupture the equipment and the resulting fragments could damage nearby safety equipment. After significant discussion between the Board and the Savannah River Site on the analyses, the Savannah River Site developed an acceptable path forward: (1) pipes that could fail without fragmenting would have their design credited; (2) seal pots that could fail with fragmenting would be reinforced with a carbon/epoxy composite wrap (approved for high pressure piping repairs); (3) components in personnel corridors would be upgraded, reinforced, contained, isolated, or removed; and (4) a safety management program would be implemented to ensure proper safeguards during maintenance.

Idaho Cleanup Project

High-Level Waste Tank Closure. During 2006, the Board completed its review of DOE's cleaning of high-level waste tanks and found the level of cleanliness adequate to protect the public and the environment. Seven of eleven 300,000 gallon tanks and four 30,000 gallon tanks were cleaned and found acceptable for closure by the State of Idaho. Concurrently, the Nuclear Regulatory Commission issued its decision that the residual waste in the tanks was incidental to reprocessing and concurred in DOE's decision under Section 3116 of the National Defense Authorization Act of 2005 that the tanks could be closed in place with cement grout. DOE grouted and closed three of the smaller tanks before the end of the year. The Board plans to observe future tank closure operations at Idaho.

3.3.2 Low-Level Waste and Transuranic Waste

Advanced Mixed Waste Treatment Project. DOE's largest effort to retrieve transuranic waste at the Idaho Cleanup Project takes place at the Advanced Mixed Waste Treatment Project, and the Board continues to provide close oversight of the activities there. As of December 2006, DOE has successfully shipped more than 14,000 cubic meters of transuranic waste to the Waste Isolation Pilot Plant. However, many thousands of cubic meters of waste remain to be packaged and shipped. The Board remains concerned about the safety of the

workers there, who could be at risk from potential deflagrations and fires in transuranic waste drums. The Board discussed these concerns with DOE, and site managers began to take action to improve the safety controls associated with handling transuranic waste drums. The Board expects to review these corrective actions in 2007.

Accelerated Retrieval Project. DOE operates a second activity to retrieve transuranic wastes buried at the Idaho Cleanup Project. This smaller operation, run by a different site contractor, is called the Accelerated Retrieval Project. The Board monitored DOE's performance at the Accelerated Retrieval Project following a drum fire there in November 2005 which caused an interruption in retrieval of transuranic waste drums until May 2006. Site personnel made several equipment and procedural changes to improve worker and public safety. However, following resumption of retrieval activities, site personnel noted that one corner of the structure covering the waste trench had settled into the ground. The corner settled far enough to cause concern for the structural integrity of the facility. DOE took corrective action to stabilize the foundation of the structure, but additional settling may occur. Additional Board review is needed to assess the structural stability of this facility.

Oak Ridge National Laboratory Tank W-1A. Tank W-1A collected radioactive wastes from analytical facilities at Oak Ridge National Laboratory between 1951 and 1986. Leakage from a pipe supplying this underground tank caused soil and groundwater contamination around the tank. Due to the high projected radiation levels, the Board carefully examined work planning for a campaign to retrieve contaminated soils for sampling and characterization in support of eventual removal and disposal. In a January 2006 letter to DOE, the Board identified weaknesses in various aspects of the integrated safety management program for the sampling effort. In response, DOE took corrective actions including practicing the sampling process prior to startup and employing improved radiological soil handling equipment and improved radiological controls to minimize worker exposure. DOE safely completed the Tank W-1A soil sampling effort in the summer of 2006. Future efforts to complete all soil removal around Tank W-1A will require additional Board oversight.

National Transuranic Waste Program. DOE stores large quantities of transuranic waste on concrete pads and in soil-covered trenches at many sites, and is actively retrieving this waste for shipment to the Waste Isolation Pilot Plant for disposal. Noting that significant differences exist in the safety requirements governing such work at the various sites, the Board encouraged DOE's initiative to develop a draft standard for the safe retrieval and characterization of transuranic waste at these sites. The Board reviewed a draft of the standard and will continue to interact with DOE to ensure that a consistent and enhanced approach to safety is taken during transuranic waste retrieval, characterization, and shipping operations.

Waste Isolation Pilot Plant. The Waste Isolation Pilot Plant in New Mexico is a geologic repository utilized for the disposal of defense transuranic wastes. During 2006, the site received and deposited more than 1,100 shipments of transuranic waste with a total volume in excess of 10,000 cubic meters. Throughout 2006, the Board verified that these operations were conducted safely. In late 2006, the Board reviewed preparations for remote-handled (high activity) transuranic waste operations, including observation of a DOE operational readiness review. As DOE makes final preparations for and begins receipt of the remote-handled transuranic waste in 2007, the Board plans to provide direct oversight.

Soil Remediation at Hanford. The Board reviewed DOE's safety documentation and work planning process for the 118-K burial ground at Hanford. DOE plans to exhume wastes from the burial ground, repackage the waste, and dispose of it in modern waste facilities. The Board found (1) confusing nuclear criticality safety controls and (2) safety documentation that did not comply with guidance from DOE. The Board provided this feedback to DOE, which resulted in DOE making the necessary changes to address these issues.

Transuranic Waste Drum Handling at Hanford. The Board reviewed hydrogen controls for vented transuranic waste drums at Hanford and found the controls to be non-conservative. DOE was using a control level of 15 percent hydrogen, while the safe and commonly accepted control level is 4 percent (the lower flammability limit for hydrogen). After this concern was communicated, DOE reduced the control level for hydrogen concentration in vented drums to 5 percent. This action represented a significant improvement in worker safety for these operations.

3.4 Facility Deactivation and Decommissioning

3.4.1 Overview

DOE's Office of Environmental Management continues to pursue accelerated deactivation and decommissioning at some defense nuclear facilities, while other such work has been delayed due to funding shortfalls. DOE completed closure activities at the Fernald Closure Project and made significant progress in the cleanup of the Miamisburg Closure Project (formerly called the Mound Site). The Board observed much of the ongoing deactivation and decommissioning work and found that weaknesses exist in the areas of nuclear criticality safety, fire prevention, and conduct of operations. Although DOE has taken corrective actions to strengthen these programs, additional improvement is needed. Lessons learned from completed work are not always implemented at new closure sites. A positive observation is that a number of personnel trained in deactivation and decommissioning have moved from existing and closed sites to sites with new work, bringing with them valuable experience and lessons learned. The Board has encouraged DOE to maintain the experienced deactivation and decommissioning work force within the defense nuclear complex.

3.4.2 Fernald Closure Project

The Board reviewed and provided comments to DOE on the safety of final decommissioning and closure project work at the Fernald Closure Project. In response, DOE made changes to improve safety during the demolition of the silos waste treatment facilities and during placement of low-level wastes in the on-site disposal cells. DOE completed all site closure work in fiscal year 2006. DOE transferred responsibility for continued site stewardship from the Office of Environmental Management to the Office of Legacy Management.

3.4.3 Miamisburg Closure Project

The Board reviewed the safety of closure activities at the Miamisburg Closure Project, including the demolition of former production buildings and removal of contaminated soil from site landfills. No significant safety issues were identified. Site closure work is complete, except

for the removal of contaminated soil from one landfill and the rail car loading area. The Board plans to follow the deactivation and decommissioning activities on site through completion, expected in fiscal year 2007. Ownership of the site will be transferred to the Miamisburg Mound Community Improvement Corporation for commercial use after all site cleanup work is complete.

3.4.4 Savannah River Site

The Board reviewed DOE's efforts to conduct deactivation and decommissioning work at the Savannah River Site and concluded that the program is reasonably well run. DOE completed deactivation and decommissioning in the T and D Areas and the Naval Nuclear Fuel complex. The F-Canyon and FB-Line have been de-inventoried and placed in a cold, dark, and dry status. The remaining decommissioning work is scheduled to be completed by 2025.

3.4.5 Hanford Site

The Board conducted several reviews of deactivation and decommissioning projects at the Hanford Site. DOE is engaged in a number of such activities at Hanford including demolition of buildings in the 300 Area (former Pacific Northwest National Laboratory facilities), decontamination at the Plutonium Finishing Plant, extensive soil and groundwater remediation, and planning for deactivation and decommissioning of the K-Basins and the large "canyon" facilities on site.

Due to the redirection of funding to higher risk projects, the Plutonium Finishing Plant has been put into a reduced deactivation and decommissioning mode. DOE plans to continue deactivation and decommissioning work during fiscal years 2007 and 2008 at about one-fourth the previous level. All plant operating and vital safety systems will continue to be operated during this reduced work period. DOE plans to resume this work at higher levels in fiscal year 2010 with a target of demolishing the facility to "slab-on-grade" by fiscal year 2016. The Board's reviews found that idle areas of the plant have been placed in safe condition. Life extension studies of plant systems are in progress to determine upgrades that might be necessary to keep the systems operating until fiscal year 2016. The Board's reviews of these life extension studies indicate that the vital safety systems should be adequately maintained.

The Board had noted high numbers of nuclear criticality safety nonconformances, including violations of mass and spacing controls, that were occurring during operations. DOE made significant progress in reducing these nonconformances from approximately five per month 18 months ago to a current rate of approximately one per month. The techniques for achieving this improvement were innovative and will provide valuable lessons learned for other facilities with fissile material holdup.

3.4.6 Idaho Cleanup Project

The Board reviewed the deactivation and decommissioning activities at the Idaho Cleanup Project and found an aggressive program to remove surplus facilities. The level of staffing was judged optimum for this work. It consisted of a combination of experienced workers from other sites, such as the Rocky Flats Environmental Technology Site, and experienced

personnel from Idaho. The Board found the work to be conducted in a manner that was protective of the workers, the public, and the environment. The most hazardous facility is the former Idaho Chemical Processing Plant, which was used to process spent nuclear fuel from the on-site test reactors and from the U.S. Navy until 1992. DOE initiated characterization and planning for deactivation and decommissioning of the Idaho Chemical Processing Plant in fiscal year 2006. The Board plans to closely monitor this high risk deactivation and decommissioning activity.

4. Nuclear Facilities Design and Infrastructure

4.1 Introduction

The Board's strategic performance goal for this area is to ensure that new defense nuclear facilities and major modifications to existing facilities are designed and constructed in a manner providing adequate protection of the health and safety of the workers and the public. There has been a substantial increase in the number of design and construction projects under the Board's jurisdiction. DOE has undertaken design and construction projects with a projected total cost of about $20 billion. The Board continues to expend extensive resources to ensure that designs for defense nuclear facilities incorporate multiple layers of safety controls commensurate with the hazards presented.

The Board is required by statute to review the design and construction of defense nuclear facilities, which must be designed and constructed in a manner that will support safe and efficient operations for 20 to 50 years. This demands an exacting design process, guided by integrated safety management principles, that will ensure appropriate safety controls are identified early in the design. The Board expects the design and construction process for defense nuclear facilities to demonstrate clear and deliberate use of integrated safety management principles, core functions, and manuals of practice.

The Board began a series of public hearings in 2005, continuing through 2006, concerning the integration of safety in design. As a result of these public hearings, DOE has established new expectations for identifying and resolving safety issues earlier in the design process, revised the existing DOE Order for project management, and is developing more detailed guidance for project management. Further, DOE is developing a new standard to implement a more rigorous approach to safety-in-design. The Board is preparing for a third public hearing on integration of safety into design that will consider early issue identification, communication between the Board and DOE, and timely resolution of issues.

House Conference Report 109-702, issued September 29, 2006, directed the Board and DOE to continue discussion on the timely identification and resolution of technical differences over design standards and other issues at DOE's nuclear facilities. The Board is required to provide quarterly reports to the Congressional defense committees to identify and report the status of significant unresolved issues.

4.2 Hanford Site

Waste Treatment Plant. The Waste Treatment Plant is a multi-facility complex designed to treat Hanford's high-level radioactive liquid wastes. It consists of three primary nuclear facilities known as Pretreatment, Low-Activity Waste, and High-Level Waste, as well as an Analytical Laboratory. The Pretreatment facility receives high-level waste from Hanford's tank farms and separates it into high and low activity streams. The low-activity portion will be transferred to the Low-Activity Waste facility, where it is mixed with glass-forming materials and converted to a stable borosilicate glass, or "vitrified." The glass canisters from the Low-Activity Waste facility are subsequently placed in an onsite, near-surface disposal facility. The high-activity waste stream is transferred from the Pretreatment facility to the High-Level Waste

facility, where it is also vitrified. After vitrification, high-level waste glass logs are temporarily stored at the Hanford site in the Canister Storage Building pending shipment to DOE's high-level waste repository.

Construction progress varies among the facilities. Currently, construction of the Low-Activity Waste facility is furthest along. Work on the Pretreatment and High-Level Waste facilities has been temporarily halted by DOE to address budget issues. In the meantime, the Board has continued its review of the design and construction of important-to-safety structures, systems, and components. During 2006, the Board's activities primarily consisted of considering the resolution of previously identified issues.

Structural Design. In response to a finding by the Board that seismic requirements were not sufficiently conservative, DOE determined that these requirements had been underestimated by about 40 percent. DOE is now evaluating the effect of this increase on the design of the structure and equipment and, using state-of-the-art techniques, is developing new data to resolve some uncertainty in the modeling used to predict the seismic hazard. DOE has undertaken a seismic borehole project under the direction of the Pacific Northwest National Laboratory. Three deep boreholes and one deep corehole have been drilled adjacent to the construction site. Once all of the subsurface data is collected, confirmatory ground motion calculations will be performed. Pacific Northwest National Laboratory is expected to form a peer review panel that will review the subsurface data and recommend how these data should be used to estimate earthquake ground motion. In a September 6, 2006 letter to DOE, the Board reiterated its belief that the updated ground motion criteria provide a reasonably conservative basis for validating the design. This conclusion was based on an analysis (using a conservative selection of soil and rock properties) that addressed recognized uncertainties in subsurface material properties. The Board anticipates that ground motion modeling using data from the drilling program will validate the seismic design ground motion. The Board raised several issues specifically regarding the structural design: inadequate modeling, no clear seismic load transfer capability in the structure, and an inadequate finite element analysis. DOE developed new structural design criteria that addressed the issues raised by the Board.

Fire Protection. The Board objected to DOE's decision not to apply fire resistant coatings to structural steel. DOE changed course and is now committed to a fireproofing strategy complying with the building code and other DOE requirements. DOE has prepared structural design criteria for implementing this strategy across the project and is completing calculations to determine which steel members must be coated. The Board is also reviewing DOE's effort to repair weather damage to coatings, and the validation of the fire rating of coatings applied by a method not meeting code requirements.

Hydrogen Gas Hazards. DOE significantly underestimated the impact of hydrogen hazards on pipes and small process vessels and components. At the urging of the Board, DOE has continued to evaluate design solutions to address the issue and re-evaluated and issued new design criteria to ensure the design remains fully protective of the public's health and safety.

Demonstration Bulk Vitrification Project. The Demonstration Bulk Vitrification Project is a research and development project intended to demonstrate the suitability of bulk vitrification for disposing of low-activity waste from the Hanford Tank Farms. In a letter to DOE

dated September 7, 2005, the Board pointed out weaknesses in the design for confinement of materials and worker protection. DOE subsequently conducted an independent review and further analyses of hazards, leading to improvements in the design.

K-Basin Closure Project Sludge Treatment. Sludge treatment is a sub-project in the overall K-Basin Closure Project. The Sludge Treatment Project is a major modification to two operating facilities that will provide capability to treat waste sludge from corroded spent fuel and package it for disposal. The project is approaching what would be Critical Decision-3 (Start of Construction). The Board has identified portions of the preliminary documented safety analysis that are based on the conceptual and preliminary design instead of the final design. A revised analysis based on the final design is expected to be delivered in early 2007. At that point, the Board can complete its review of the adequacy of the design.

Interim Secure Storage Facility. The Interim Secure Storage Facility was a new project at Hanford to store the site's inventory of plutonium until 2035. The Board questioned DOE's application of project management requirements to the project. DOE's project team subsequently developed a critical decision package for approval which, upon further review, revealed that the mission need was not justified. DOE eventually terminated the project in favor of consolidation of plutonium storage off-site.

4.3 Savannah River Site

Plutonium Storage. The 3013 Container Surveillance and Storage Capability project is a major modification to a Hazard Category 2 facility within the K-Area Complex. This project will provide examination, stabilization, and packaging capabilities for plutonium-bearing materials stored in 3013 containers. It will also provide rack storage for approximately 1900 containers. The Board reviewed the preliminary design of the facility, focusing on the preliminary hazards analysis, proposed safety systems, and criticality safety strategy. The Board identified weaknesses in the hazards analysis, which the contractor agreed to address. Based on the Board's Recommendation 2004-2, the contractor discovered that the preliminary facility design did not protect safety-related filters from excessive soot loading during fire events. The design and functional classification of the ventilation and fire protection systems were subsequently modified, though DOE has not yet approved the new design. The Board also encouraged DOE to ensure that its decision regarding exclusion of criticality accident alarms in the facility takes into account the revised design requirements found in DOE Order 420.1B, *Facility Safety*.

K-Area Interim Surveillance Project. The K-Area Interim Surveillance project will provide the capability to conduct non-destructive and destructive surveillance of 3013 containers in the Building 105-K slug vault until the 3013 Container Surveillance and Storage Capability facility becomes operational (in about 2010). The Board reviewed the final design of this facility, focusing on the ventilation and fire protection systems, and found it acceptable. The Board identified several deficiencies in the documented safety analysis and nuclear criticality safety evaluation; the contractor corrected these in later revisions. The Board also identified a potential threat to the safety-significant ventilation system from an old non-seismically qualified ventilation duct in Building 105-K. DOE removed the duct.

Salt Waste Processing Facility. The Board continued its review of the Salt Waste Processing Facility's design and processes. The Board had previously identified weaknesses in the performance categorization and potential seismic interactions of various portions of the facility. As a result, DOE directed its contractor to design a more robust structure, which will provide the confinement required by the DOE safety basis. This facility is of particular concern to the Board because of observed technical shortcomings in the design process. The geotechnical requirements have not been finalized, the as-designed structure's ability to transfer imposed loads is not well defined, the structural analysis to date is incorrect and less than adequate, and the structural models developed to advance the design may not be valid. DOE is taking action to address these issues with the Board's assistance to minimize impacts on the Savannah River Site's high-level waste program.

Pit Disassembly and Conversion Facility. In 2006, the Board continued to review safety aspects of the design of the Pit Disassembly and Conversion Facility. The Board reviewed the surface settlement profiles at the building foundation due to the presence of soft zones unique to the Savannah River Site. Based on this review, the Board found that, although the final predicted surface settlement is deemed adequate, the methods used to analyze surface settlement need to be improved. The Board will address this concern with the Savannah River Site separately. The Board also suggested several improvements in the electrical design. The Board observed that the design rating of the diesel generator may not be adequate to handle the necessary startup loads following a loss of offsite power.

Tritium Extraction Facility. The Tritium Extraction Facility will be used to extract tritium from target rods irradiated in commercial light water reactors. The extracted tritium is used to replenish tritium reserves for the nation's nuclear weapons stockpile. DOE successfully started up this facility in 2006.

4.4 Y-12 National Security Complex

Highly Enriched Uranium Materials Facility. The Highly Enriched Uranium Materials Facility will replace several aging storage facilities. The new facility will reduce the site footprint of uranium storage, thus simplifying safeguards and security measures. The design of this facility is essentially complete. DOE began construction in early 2005, with completion now projected in 2008. In late 2005, the Board noted that quality assurance and control practices for placement of concrete were deficient. In response, DOE assigned personnel to monitor construction and initiated other corrective actions. In January and February 2006, however, shortly after DOE initiated corrective actions, DOE's contractors identified numerous construction errors in concrete placement. DOE then shut down construction activities and initiated short-term compensatory actions including a review by outside construction experts. Subsequently, DOE developed and implemented long-term corrective actions to address the quality assurance and control deficiencies.

Uranium Processing Facility. The Uranium Processing Facility is a new project intended to replace a number of aging facilities that process enriched uranium. In 2006, the project's completion schedule was in doubt due to funding reductions. DOE's review and approval of Critical Decision-1 authorizing preliminary design is being delayed until project management problems at the Highly Enriched Uranium Materials Facility are sufficiently

resolved. The Board has raised concerns with the development of the preliminary hazard analysis and selection of a conservative set of safety-related controls. The Board has also questioned the level of detail developed for the conceptual design of the safety systems and the risks this may pose for the project.

4.5 Los Alamos National Laboratory

Chemistry and Metallurgy Research Facility Replacement Project. The Board continued its review of the Chemistry and Metallurgy Research Replacement Project facility design. To expedite the schedule, DOE is planning to use a design-build approach for the final design and construction of this facility. DOE proposes to combine Critical Decision-2 (Approval of Performance Baseline) and Critical Decision-3 (Start of Construction). For this strategy to be successful, the preliminary design package needs to be more developed than would typically be expected. This approach will also require a completed preliminary documented safety analysis with a DOE safety evaluation report. The Board has stressed that for this plan to be successful, aggressive oversight will be required by federal and contractor personnel experienced in the management and oversight of large, complex projects. There are many safety-related issues and concerns with this project that remain to be resolved. The Board will continue its efforts to achieve resolution in a timely manner.

Pit Manufacturing, Technical Area-55. Upgrades are currently underway to improve the pit manufacturing capability at Technical Area-55. Overall, the objective of these efforts is to install manufacturing equipment necessary to produce increased numbers of pits and establish the capability to manufacture legacy pit types or a Reliable Replacement Warhead. The Board has found that this activity is not being managed as a formal project with design milestones in accordance with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*. Rather, modifications to the pit manufacturing facilities and equipment are ongoing and funded on an annual basis. The Board is currently evaluating whether the lack of adherence to DOE Order 413.3A is adversely affecting safety integration within the design.

4.6 Pantex Plant

Component Evaluation Facility. The Component Evaluation Facility is a new project at Pantex intended to provide additional capability for qualifying, certifying, and inspecting assembled weapons and components. This project is presently on hold while NNSA is revisiting the Program Requirements Document and Mission Need to ensure compatibility with the Reliable Replacement Warhead and the Complex 2030 vision. This facility was scheduled to be operational in 2012.

Special Nuclear Material Component Requalification Facility. The Board has continued its review of the Special Nuclear Material Component Requalification Facility. The project team has completed construction and system testing and is currently resolving Operational Readiness Review findings from the recently completed contractor review. The critical path for this project is controlled by the Laser Gas Sampling System, which is not required immediately for stockpile work and is expected to lag production startup. The Board conducted reviews of the ventilation and fire protection systems and of safety basis documentation. The Board noted that though the facility is equipped with an active ventilation

system, this system is not credited in the safety analysis. This issue will be evaluated in connection with Recommendation 2004-2.

4.7 Idaho Cleanup Project

Integrated Waste Treatment Unit. The Integrated Waste Treatment Unit will convert approximately 900,000 gallons of acidic sodium-bearing tank waste at the Idaho National Laboratory to a dry carbonate product for disposal at the Waste Isolation Pilot Plant. The Board reviewed major aspects of the project's organization, preliminary design, and safety basis development. Primary areas of focus included process design and confinement strategy, safety strategy as detailed in the preliminary documented safety analysis, and pilot plant testing. In response to the Board's concerns, DOE will use a more conservative and commonly used computer code to estimate radiological consequences of postulated accidents for co-located workers and the public. Further, DOE conducted a review of key safety analysis inputs and subsequently changed these inputs for many of the postulated accidents. The Board is continuing to review major aspects of the design as they are developed, including the distributed control system, waste characterization and radionuclide inventory controls, geotechnical engineering work supporting the design of Performance Category 3 structures, and additional pilot plant testing.

4.8 Nevada Test Site

Criticality Experiments Facility. The Criticality Experiments Facility is a major modification of the Device Assembly Facility. This modification will permit transfer of criticality machines and fuel from Technical Area-18 at Los Alamos to the Nevada Test Site. Design is about 90 percent complete on modifications to the rooms within the Device Assembly Facility that are needed for this project. The Board reviewed the preliminary documented safety analysis and developed a significant number of comments and concerns. Many of these concerns were shared by DOE's Safety Basis Review Team. DOE now plans to perform a new structural and seismic analysis, address water leaks, and prepare a new safety analysis. However, as noted in Section 2, the Device Assembly Facility structure has numerous cracks that are considered abnormal for a nuclear facility.

4.9 Seismic Hazard Analysis

The Board is reviewing a number of DOE studies and reports on seismic ground motion. DOE Order 420.1B, *Facility Safety*, requires that a review of natural phenomena hazards assessments be conducted at least every 10 years, and that this review include recommendations to DOE for updating the existing natural phenomena hazard assessments based on significant changes that have occurred in methods or data. As a result of this requirement, a number of DOE sites are updating their probabilistic seismic hazard analyses. These analyses will be used to establish the site-specific design basis earthquake ground motion. During the past 10 years, the practice for establishing earthquake ground motions has advanced, particularly with respect to understanding the impact of local site conditions on ground motions. Local site conditions can have a significant impact on either amplifying or reducing ground motions depending on the geologic stratigraphy and related material properties of the site.

Probabilistic seismic hazard updates are underway at the Savannah River Site, Los Alamos National Laboratory, and the Nevada Test Site. These updates were undertaken to incorporate the most recent data regarding seismic sources, including the Charleston, South Carolina source at Savannah River Site and the Pajarito Fault source in New Mexico. Studies to better understand the impact of local site conditions are also underway at the Hanford Site (Waste Treatment Plant) and at the Idaho National Laboratory (Integrated Waste Treatment Unit). Given that the state of practice is evolving, one key concern of the Board is that DOE perform an adequate review, including independent peer review, of both the site specific acquisition of data and the subsequent analysis. This will ensure that design basis earthquake ground motions are based on accurate scientific knowledge. The Board will continue its review of this ongoing work during 2007.

5. Nuclear Safety Programs and Analysis

5.1 Federal Oversight

5.1.1 Overview

To meet its statutory health and safety mandate, the Board must continuously assess DOE's ability to achieve adequate oversight of contractor work. Oversight, in this context, includes Federal line-management assessment of contractors, contractor self-assessment, and independent assessment of both Federal and contractor work. For much of the work conducted in the defense nuclear complex, DOE relies upon contractors to perform inherently risky activities in government-owned facilities. These activities are nevertheless governed by nuclear safety requirements promulgated by the government. Thus, DOE fills three simultaneous roles: owner, customer, and regulator. Preventing conflict among these roles requires a complex oversight system strained by competing demands that must be reconciled to ensure that the overall mission is achieved safely.

5.1.2 Recommendations 95-2 and 2004-1

The Board continued driving DOE to improve its oversight of complex, high-hazard nuclear operations. One important aspect of that oversight is integrated safety management, a concept that evolved from Recommendation 95-2 and is being further developed and implemented in response to Recommendation 2004-1. The basic tenets of this approach provide the framework for safely performing all of the diverse hazardous activities in the defense nuclear complex. Integrated safety management provides for a single safety management program rather than multiple, unintegrated programs (e.g., quality assurance and environmental management). Nuclear safety is an important but not exclusive target, because nonradioactive hazardous materials and operations can also present significant risk. Integrated safety management builds upon standards of safe practice for nuclear, chemical, and other hazardous operations to ensure protection of the public, workers, and the environment. In 2006, the Board issued a technical report, *Integrated Safety Management: The Foundation for an Effective Safety Culture* (DNFSB/TECH-36). This report documents a detailed examination of the current status and effectiveness of integrated safety management systems at the seven NNSA weapons sites, summarizes failures and good practices, and proposes changes to enhance the effectiveness of these systems.

DOE completed the following actions in 2006:

- designated a chair for the Integrated Safety Management Council;
- established two Central Technical Authorities with associated technical support staff;
- issued a new DOE policy and order on DOE oversight;
- implemented a nuclear safety research function;
- strengthened the technical qualification program for Federal safety assurance personnel;
- implemented a formal safety delegation and assignment process; and
- took steps to improve the implementation of the "feedback and improvement" function, including issuance of a new DOE Order describing the Operating Experience Program.

DOE also performed a review of Recommendation 2004-1 implementation plan commitments. Based on the results of the reviews and experience with implementation to date, DOE developed a revision to the plan that the Board found acceptable. The Board also took this opportunity to close Recommendation 95-2. The Board concluded that the Recommendation 2004-1 plan and the recently-issued DOE Manual 450.4-1, *Integrated Safety Management System Manual*, contained the actions necessary to reinvigorate integrated safety management.

5.1.3 DOE Oversight Policy and Order

In accordance with the implementation plan for Recommendation 2004-1, DOE issued a new policy and order (Order 226.1, *Implementation of Department of Energy Oversight Policy*) on federal oversight, bringing together for the first time specific guidance and detailed requirements for federal oversight of safety, security, and business operations. In development is an oversight guide providing more detailed guidelines and lines of inquiry. These steps are intended to ensure a more uniform process for oversight of DOE's activities.

The order was scheduled to be implemented by DOE and its contractors by September 2006. In early 2006, the Board's reviews showed that most sites needed to fill a substantial gap to fully implement these safety requirements by the required date. In March 2006, the Board provided to DOE the results of a detailed review of the technical assessment, safety system oversight, and management walkthrough programs at the Savannah River Operations Office. The Board's report noted a substantial gap between current performance and the requirements of Order 226.1, and expressed concern with the limited actions taken at that time to implement the new order.

In response to the Board's March 2006 letter, DOE assigned a lead at Savannah River for implementing the new requirements, conducted a formal gap analysis, and developed an implementation plan. In addition, DOE developed a new Integrated Performance Assurance Manual and plans to conduct structured and comprehensive assessments of the contractor's performance starting in 2007. While significant improvements were made in 2006, progress was hindered by a number of DOE staffing deficiencies. The Board is also concerned that the decision to increase the number of contractors at Savannah River and the increased use of small business contracts in the future will make the situation even more challenging.

The Board's March 2006 letter also requested that DOE provide its implementation plans for the new directives across the complex and encouraged DOE to take aggressive steps to implement the 226 series of directives. These steps could include assigning a lead for implementing the new requirements, performing a formal gap analysis, and developing an implementation plan. Without these, or similar positive steps, the Board had little confidence that the programs would be implemented within the one-year requirement. DOE provided plans to the Board for implementing the directives in June 2006, and more detailed implementation plans in September 2006. At the end of 2006, however, implementation of the new directives was still not complete. The Board will continue to follow implementation and effectiveness of the federal oversight programs in 2007.

5.1.4 Vital Safety Systems

In response to Recommendation 2000-2, DOE has taken steps to ensure the operability of vital safety systems. During 2006, at the request of the Board, DOE reported its progress. Based on a detailed review of the information provided, the Board has concluded that two sites, Lawrence Livermore National Laboratory and the Los Alamos National Laboratory, have not fully implemented a program to verify configuration management of vital safety systems.

5.1.5 Activity-Level Work Planning

The Board has continuously emphasized the importance of ensuring that hazards are identified and controlled, work is performed in a careful manner in accordance with the safety controls, and that DOE uses appropriate feedback mechanisms to ensure continuous improvement at the individual activity level. In its implementation plan for Recommendation 2004-1, DOE acknowledged the need to strengthen this area and committed to enhanced focus on work planning and work control at the field office level. In 2006, the Board continued to provide technical oversight of activity-level work planning within the DOE complex. Reviews of three activities at the Hanford site and one at Oak Ridge National Laboratory were conducted. At both of these sites, DOE had made significant improvements, but it is too early to tell if these changes have been fully captured in institutional policies and procedures.

5.1.6 Small Business Contracting

Section 6022(c) of Public Law 109-13 mandated that the Administrator of the Small Business Administration, Chief Counsel for Advocacy of the Small Business Administration, Chairman of the Defense Nuclear Facilities Safety Board, Secretary of Energy, and Administrator of NNSA jointly conduct a study on means to promote opportunities for small business participation in DOE's contracting system. While the study covered contracting for all DOE facilities, the Board limited its involvement to contracts at defense nuclear facilities.

The Board provided its input to DOE for the report on September 2, 2005 and DOE issued the final report on June 27, 2006. The Board noted that in exercising its safety oversight responsibilities, it has no preference on the size of contractors managing defense nuclear facilities or activities. The Board expects defense nuclear work to be conducted safely. Hence, regardless of the size of the contractor, work should be conducted under the same contractual requirements, with the same degree of formality, and with the same level of safety oversight by DOE and the Board. The Board noted that substantially increasing the number of prime contractors increases the number of DOE staff necessary to discharge non-delegable safety functions. DOE is already short of trained staff.

5.2 Health and Safety Directives

5.2.1 Improvement of Directives

In 2006, as part of its ongoing review of new and revised DOE directives, the Board evaluated and provided constructive critiques of 38 directives dealing with nuclear design criteria, maintenance management, worker protection, emergency management, and project

management. At year's end, the Board's staff was working to resolve safety issues on 23 directives. Work was completed on these directives:

- DOE Order 151.1X, *Comprehensive Emergency Management System*
- DOE Order 251.1X, *Directives Program*
- DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*
- DOE Order 420.1B, *Facility Safety*
- DOE Guide 424.1-1A, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*
- DOE Order 452.1C, *Nuclear Explosive and Weapon Surety Program*
- DOE Order 452.2C, *Safety of Nuclear Explosive Operations*
- DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis Documents*
- DOE Manual 450.5-1, *Integrated Safety Management Manual*

5.2.2 NNSA Policy Letters

On several occasions the Board expressed concern over a new family of directives called "policy letters" that had no standing in DOE's directives system. In response, NNSA agreed to suspend applying these documents to defense nuclear facilities until a satisfactory directives system architecture was developed. Changing course, NNSA decided to eliminate the policy letter system entirely and replace it with a new directives system. In 2006, NNSA presented to the Board its plans for new directives to be issued in 2007.

5.2.3 Natural Phenomena Hazards

In an August 27, 2004 letter to DOE, the Board requested improved technical criteria for systems, structures, and components relied upon to confine radioactive materials threatened by natural phenomena. In 2005, DOE provided a revision to DOE Guide 420.1-2, *Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities*. The Board provided comments on this revision, suggesting that DOE consider adopting the consensus standard American National Standards Institute/American Nuclear Society Standard 2.26-2004, *Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design*, rather than revising the guide. DOE has elected to adopt this national consensus standard by providing guidance for its implementation in a new standard, DOE-STD-1189, *Integration of Safety into the Design Process*.

5.2.4 Worker Safety Rulemaking

On December 8, 2003, DOE published in the *Federal Register* a proposed rule on worker protection, 10 CFR Part 851, *Worker Safety and Health*. This action was required under the Bob Stump National Defense Authorization Act, Public Law 107-314, which directed DOE to promulgate regulations on worker safety and health, rather than rely exclusively on a contractual approach. On January 26, 2005, DOE published a revised proposed rule for public comment. The Board's comments on this rule stressed tightening the proposed exemption criteria, strengthening the tailoring process, and complying with the oversight themes of Recommendation 2004-1. DOE modified the proposed rule considerably based on input from the Board, and published the

final rule on February 9, 2006. The Board also provided oversight of DOE's development of DOE Guide 440.1-8, *Implementation Guide for Use with 10 CFR Part 851, Worker Safety and Health Program*, which was issued in January 2007. The rule's full implementation is required by May 2007.

5.2.5 Hazard Categorization

In a letter dated June 26, 2006, the Board requested that DOE review and address issues associated with the implementation of DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, Change Notice 1*. The letter described specific problems observed throughout the complex, including inappropriate exclusion of sealed sources from facility inventories, the interaction between hazard categorization and criticality safety, and poorly defined technical bases for threshold values. Improper application of the standard can result in non-conservative facility hazard categorization and a reduced set of safety requirements and controls. DOE responded on October 25, 2006, with a letter committing to the establishment of a working group to address these and other weaknesses in the standard and develop a path forward for resolution, which will be available by March 2007.

5.2.6 Scope of the Directives System

In response to previous input from the Board, DOE offered changes to DOE Policy 251.1, *Directives Program Policy*, DOE Order 251.1X, *DOE Directives Program*, and DOE Manual 251.1-1X, *Directives Program Manual*. The Board's oversight resulted in a significantly improved series of directives that provide the framework for the development of all other safety directives. The directives in the 251 series were published in August 2006.

5.3 Safety Programs

5.3.1 Administrative Controls

Contractors at defense nuclear facilities are required by DOE's principal nuclear safety rule (codified in 10 CFR Part 830) to submit documented safety analyses and controls for approval. To meet this requirement, many contractors have developed new safety analyses and, perhaps more importantly, new safety controls. In many cases, the choice of these new safety controls was limited because the installed equipment had been built years or even decades ago. This led some contractors to reclassify existing equipment as safety-related and to rely on safety-related administrative controls rather than engineered features. In Recommendation 2002-3, the Board advised DOE to improve its guidance for the use of administrative controls at defense nuclear facilities.

Responding to the recommendation, DOE developed and implemented a plan to improve the reliability and effectiveness of administrative controls that serve important safety functions. As a key step in the implementation plan, DOE developed and issued a new standard, *Specific Administrative Controls* (DOE-STD-1186), and in 2006, completed the commitments outlined in the implementation plan for Recommendation 2002-3. Of particular note, DOE revised the safe harbor methodology associated with the performance of safety analyses (DOE-STD-3009,

Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses) to reflect the requirements associated with specific administrative controls. The Board intends to conduct independent verification reviews to assess the effectiveness of implementation.

5.3.2 Active Confinement Systems

The Board issued Recommendation 2004-2 to ensure that a reliable and effective control would be available to mitigate the consequences of potential accidents at defense nuclear facilities that rely on confinement ventilation systems. DOE has now screened all Hazard Category 2 and 3 defense nuclear facilities against criteria designed to identify those with the potential for benefitting from the intent of the recommendation. DOE also completed another major milestone in February 2006, developing and issuing its Ventilation System Evaluation Guidance document. This document identifies a set of design and performance attributes that ventilation systems should be evaluated against for identification of potential upgrades. Several pilot facilities have been identified by DOE to which these attributes will be applied, in order to identify potential improvements, before the guidance document is applied to the rest of Hazard Category 2 and 3 facilities that were identified earlier in the year. The evaluation process will be completed over the next two years, resulting in significant improvement in the safety posture of defense nuclear facilities across the complex.

In 2006, DOE submitted a revised implementation plan to reflect delays that have occurred. The Board objected to these changes in an August 2006 letter, noting that DOE had removed the Central Technical Authority from the review and concurrence process and eliminated the Central Technical Authority's responsibility for ensuring technical adequacy. The Board also objected to the removal of the Program Secretarial Officer from the review and approval process for exceptions, giving that authority over to the site manager. Over the Board's objections, DOE elected to follow the revised implementation plan. The Board has been informed that the Office of Environmental Management and the National Nuclear Security Administration have provided guidance to explain the coordination and level of reviews expected by these program offices for ventilation system evaluations, including review and oversight by the Central Technical Authorities and subsidiary offices. The Board is evaluating DOE's implementation plan and will closely follow the implementation of the recommendation in 2007.

5.3.3 Quality Assurance

During 2006, the Board continued to urge DOE to improve the implementation of quality assurance programs. In accordance with its Quality Assurance Improvement Plan, DOE is reviewing quality assurance processes at its various sites and developing corrective actions where needed. The Quality Assurance Working Group (under the auspices of the Energy Facility Contractors Group) continues to assist DOE in making these improvements. The actions taken as part of NNSA's "Quality Assurance Roadmap to Excellence" also continue to have a positive effect. The Board also provided representation at the biannual meeting of the American Society of Mechanical Engineers' committee devoted to NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities.*

5.3.4 Software Quality Assurance

The safe design and operation of many defense nuclear facilities is assured, in part, by analysis and operational support provided by computer software. In January 2002, the Board issued Recommendation 2002-1 to force significant changes in DOE's policies and practices regarding software design, implementation, testing, configuration management, and training of personnel in order to address longstanding safety deficiencies in these areas. During 2006, the newly revised DOE Order 414.1C, *Quality Assurance*, that contained new software quality assurance requirements, was added to NNSA contracts. At this point, DOE has completed all but one action in the implementation plan. DOE performed a gap analysis on its toolbox of codes to determine the actions needed to bring them into compliance with software quality assurance qualification criteria. However, the funding to upgrade codes based on the gap analysis results has not been available. DOE will brief the Board on its plan for correcting this deficiency in 2007.

5.3.5 Risk Assessment Methodologies

Previously, the Board conducted a comprehensive assessment of DOE's policies, programs, processes, and procedures with respect to the use of quantitative risk assessment and related methodologies. This review found that DOE widely employed quantitative risk assessment but without adequate controls over quality and applicability. This in turn causes risk management plans, risk mitigative actions, and residual risk identification to be inadequate. DOE responded by offering to develop a policy governing the use of risk assessment methodologies at defense nuclear facilities.

In a letter to DOE dated November 23, 2005, the Board found deficiencies in the policy as written and objected to the slow pace of its development. As a result of the Board's observations and concerns, DOE has chartered a working group comprising representatives from the major program offices, field elements, national laboratories, and major contractors to guide the efforts in this area. This group has developed a draft policy, along with draft implementation guidance, which is scheduled to be released for general comment in early 2007. The Board will continue to oversee DOE's progress in developing an effective policy and useful implementing guidance to govern the use of risk assessment methodologies at DOE facilities.

5.3.6 Criticality Safety

The Board continued to monitor DOE's progress in improving nuclear criticality safety programs. The Board reviewed a DOE report entitled *Status of the Department of Energy Nuclear Criticality Safety Program for Calendar Year 2005* (February 8, 2006), and in a letter dated June 28, 2006, noted favorably the positive influence of the Criticality Safety Support Group, the improved stability of funding for the criticality program, and the increased frequency of reviews under the Criticality Safety Monitoring Program. However, the Board was concerned about several items that are fundamental to the health of DOE's nuclear criticality safety program and requested that DOE provide an estimate of when critical experiments would be started at Nevada Test Site and a status report on staffing and training. In October 2006, DOE responded to the Board that critical experiment operations at Nevada Test Site are planned to resume in late 2009, and the experimenters will undergo requalification in accordance with a

training plan to be finalized in 2007. DOE also identified sites that require additional criticality safety resources to provide effective oversight and has taken action to acquire and qualify these resources. Finally, a number of engineer training courses devoted to criticality matters were held at Lawrence Livermore National Laboratory this past summer, after a nearly two-year hiatus throughout the complex.

The Board has also closely followed efforts by Los Alamos National Laboratory to correct program deficiencies identified during an October 2005 review. A review in early August found that progress in completing the corrective actions had stalled. Subsequently, the Board issued a letter on September 22, 2006, asking DOE what compensatory measures would be put in place until the laboratory's program deficiencies could be corrected. DOE responded in a letter dated November 2, 2006, stating that it has increased oversight of the laboratory's program and assigned a full-time individual to oversight. A limited review of compensatory measures taken for current operations determined that there were no immediate criticality safety concerns. DOE will meet periodically with contractor management to monitor progress on corrective actions. The Board will continue to monitor progress and oversight effectiveness.

At Lawrence Livermore's Plutonium Facility, a review by the Board identified two noncompliances with requirements of American National Standards Institute/American Nuclear Society Standard 8.19, *Administrative Practices for Nuclear Criticality Safety*. The Board described these noncompliances to DOE in a letter dated October 11, 2006. On November 22, 2006, DOE directed the laboratory to take action; improvements in the laboratory's criticality safety program have now been made.

5.3.7 Readiness Reviews

In a September 14, 2005 letter to DOE, the Board highlighted some instances of reduced rigor in the selection of readiness review processes for defense nuclear facilities. Such reduced rigor affects the application of design requirements and preparation of safety documents. One cause for this situation appeared to be inconsistent interpretation and implementation of rules and orders that apply to new Hazard Category 1, 2, and 3 nuclear facilities and major modifications to existing nuclear facilities. In the cases noted by the Board, DOE used non-conservative interpretations that could lead to less vigorous readiness reviews and omission of required reviews of design and safety documentation. As a result, DOE conducted a focused review at two sites and found inconsistent interpretation and application of these nuclear safety definitions. DOE will brief the Board before these definitions are revised in the DOE directive.

The Board had also identified several problems with the planning and conduct of startup readiness reviews at the Savannah River Site in late 2005. As a result, the Board provided extensive oversight of the 17 contractor and DOE readiness reviews that were conducted at the Savannah River Site during 2006 to ensure the subsequent corrective actions were producing the desired effect. In general, a significant improvement was observed. That being said, the Board disagreed with a contractor decision in a particular case in which a readiness review commenced before the supporting authorization basis had been approved. The Board also identified other problems with specific readiness reviews: frequent equipment reliability issues, lack of prerequisites in a plan of action, disclosure of an emergency drill scenario ahead of time, and

reviewer actions that could bias their review. Feedback from the Board on these issues allowed corrective actions to be taken to ensure they remained isolated cases.

Similarly, the Board identified weaknesses with the Idaho process for determining readiness to begin venting of remote-handled transuranic waste drums. DOE-Idaho gave approval to perform a readiness assessment for a new Hazard Category 2 activity instead of a more rigorous operational readiness review as required by DOE Order 425.1C, *Startup and Restart of Nuclear Facilities*, without receiving an exemption from DOE headquarters. DOE's Office of Environmental Management issued a memorandum to all of its sites providing clear expectations for implementing the requirements of the order.

5.4 Technical Competence

5.4.1 Federal

In accordance with the implementation plan for Recommendation 2004-1, DOE prepared a corrective action plan in August 2005 to address federal technical competency issues. The action plan focused on several major areas including: (1) conducting a functional workforce analysis as a basis for meeting the needs of DOE's missions for the next five years; (2) establishing a voluntary corporate accreditation process for the Technical Qualification Program based on the Institute of Nuclear Power Operation model; (3) reestablishing the corporate Technical Leadership Development Program to hire and develop new engineers; and (4) strengthening the qualification program for Senior Technical Safety Managers. DOE plans to revise its Federal Technical Capability Manual to incorporate changes in federal technical capability expectations developed as part of the implementation plan. DOE will also conduct a follow-on line management review of the effectiveness of their corrective action plan.

DOE achieved several successes in pursuing the corrective action plan. In May 2006, DOE conducted the initial accreditation review of the Technical Qualification Program at the site office for the Y-12 National Security Complex. The Y-12 Site Office had a solid program and served as a good benchmark for this accreditation process. DOE budgeted $2 million for fiscal year 2008 to reestablish the Corporate Technical Intern Program, which would fund ten interns. DOE developed and executed a Senior Technical Safety Manager overview course in Albuquerque in February 2006 for qualified managers in the process of requalification and for new manager candidates to assess gaps in their knowledge level. DOE will use lessons learned from this course to improve its next scheduled course. DOE is also strengthening its qualification criteria with mandatory performance activities through a significant revision to DOE-STD-1075, *Senior Technical Safety Manager Functional Area Qualification Standard.* DOE expects to issue this standard later in 2007.

5.4.2 Criticality Safety Engineers

In 2006, the Board assessed the nuclear criticality training and staffing at several DOE site offices in the area of nuclear criticality safety oversight. The Board found that several DOE site offices continue to be either understaffed or not staffed at all in the area of oversight. Some of the problems with contractor programs can be traced to ineffective oversight by DOE site offices. By October 2006, DOE was actively seeking to fill criticality safety positions at the

Nevada Site Office, Los Alamos Site Office, and Savannah River Operations Office. In the meantime, technical support in the criticality safety area is being provided to these sites through DOE's Albuquerque Service Center. At the Los Alamos Site Office, a general engineer has also been assigned as a full-time criticality safety engineer. He is required to complete qualification as an expert by April 2008, but DOE is exploring mechanisms to accelerate his qualification progress.

5.4.3 Federal Facility Representatives

The Board conducted on-site reviews of the staffing levels and training of DOE's facility representatives at the Pantex, Sandia, and Los Alamos Site Offices. The Board found that both staffing and training were inadequate in all three offices. DOE agreed and took steps to improve its activity-specific hazard training and to develop a more rigorous means of establishing a minimum staffing level at each office. However, DOE continues to experience difficulty maintaining the desired number of qualified facility representatives at too many sites.

6. Public Outreach and Agency Administration

6.1 Public Hearings

During 2006, the Board conducted two public hearings. The Board held its first public hearing in March at Los Alamos, New Mexico, at which it received testimony from DOE and its operating contractors for Los Alamos National Laboratory. The Board's interest was focused on improvements in safety management at the laboratory's defense nuclear facilities. The second public hearing, held in July in Washington, D.C., was the second in a series regarding DOE's incorporation of safety into design and construction projects. This hearing explored actions taken by DOE to further improve incorporation of safety early in the design process.

6.2 Responding to Public Requests

The Board answered numerous public requests for documents and information and responded to eight requests filed under the Freedom of Information Act. The average response time for requests was 5.6 working days, as compared with the statutory requirement of 20 working days. The Board's website (www.dnfsb.gov) contains a complete list of requests processed since 2001.

6.3 Electronic Access

The Board posts essential, publicly-releasable documents on its website in a timely manner in a format suitable for downloading. The Board also mails paper copies of certain documents (annual reports, technical reports, public hearing notices, and others) to a list of nearly four hundred addressees.

6.4 Inquiries into Health and Safety Issues

The Board often receives information regarding potential health and safety hazards from private citizens or from employees at defense nuclear facilities. The Board treats these matters with the utmost seriousness by assigning members of its legal and technical staffs to investigate or inquire further. These inquiries, which may involve interviews, review of documents, and site visits, are continued until the Board is able to reach a technical judgment on the issues raised. If the Board finds that a health or safety hazard exists, it takes prompt action to inform DOE and closely monitors DOE's corrective actions. When the Board receives information on matters outside its jurisdiction, such as alleged criminal activities or unlawful personnel practices, it refers the information to the appropriate federal agency for action. During 2006, the Board directed inquiries into health and safety issues at Hanford, Idaho, Los Alamos, and Pantex. These inquiries led to safety improvements in the conduct of work at the respective sites.

6.5 Site Representative Activities

The Board enhances its onsite health and safety oversight of defense nuclear facilities by assigning experienced technical staff members to full-time duty in the field. There are two site representatives at the Pantex Plant near Amarillo, Texas; two at the Hanford Site near Richland, Washington; two at the Savannah River Site near Aiken, South Carolina; two at the Y-12

National Security Complex in Oak Ridge, Tennessee; two at Los Alamos National Laboratory in New Mexico; and one at Lawrence Livermore National Laboratory in Livermore, California. Site representatives conduct first-hand assessments of nuclear safety management to identify health and safety concerns promptly. They meet regularly with the public, union members, Congressional staff members, and public officials from federal, state, and local agencies. The Board receives weekly reports and regular briefings from its site representatives in person and maintains continuous contact with them using all available communication media.

6.6 Human Resources

In the second half of 2006, the Board instituted an aggressive hiring initiative to replace retiring and otherwise departing technical staff. In addition, the Senate confirmed nominees for the two vacant Board member positions. As a result, the Board increased its personnel strength to 89 (including Board members) with four more technical staff members scheduled to arrive in early January 2007.

The Board has assembled a professional staff of exceptional technical capability. Staff members' expertise covers all major aspects of nuclear safety: nuclear, mechanical, electrical, chemical, fire protection, and structural engineering, as well as physics and metallurgy. Most mid- to senior-level technical staff members possess practical nuclear experience gained from duty in the United States Navy nuclear propulsion program, the nuclear weapons field, or the civilian nuclear reactor industry. Both the Board and its staff include individuals experienced in environmental impact assessments and regulatory processes. Four of the Board's attorneys have technical degrees, and one is also a licensed professional engineer. The Board expects its engineers and scientists to maintain the highest level of technical knowledge, encouraging them to improve their skills continually through academic study. Ninety-five percent of the Board's technical staff holds advanced science and engineering degrees, with 17 percent at the doctoral level.

Junior technical staff members continue to be recruited through the Board's professional development program. Entry-level employees recruited into this 3-year program receive graduate education and intensive on-the-job training guided by experienced technical mentors. Currently, there is one entry-level employee in this program. The Board will continue its vigorous recruitment program to attract the brightest engineering students from colleges and universities across the country.

6.7 Information Technology and Security

The Board has continued to strengthen internal controls and ensure that it is in compliance with the requirements of the Federal Information Security Management Act as well as other security guidance. The Board is implementing the processes called for by Homeland Security Presidential Directive 12 and has begun issuing cards compliant with this directive.

The Board has continued to increase its use of advanced information technology. Desktop hardware, software, and network servers provided to the staff are continually upgraded to ensure that the latest tools are available. In 2006, the Board continued to improve its information technology infrastructure to allow the adoption of emerging technologies, such as

the conversion to IPv6 and the use of credentials for logical access compliant with Homeland Security Presidential Directive 12. The Board also continued to develop more robust technology capabilities at its alternative facility. These capabilities will allow the Board to continue to operate effectively in the event of an emergency or flu epidemic. The Board's internet website is continuously updated to ensure that public documents are available for viewing and downloading. Access to documents has been improved by the installation of a better search engine.

6.8 Dispute Resolution Programs

The Board, like other federal agencies, is required by the Administrative Dispute Resolution Act of 1996 to provide an alternative dispute resolution program for use in resolving appropriate disputes. The Board maintains such a program, making use of cooperative agreements with other agencies to resolve workplace and contracts disputes economically.

6.9 Financial Management

The Board received its first unqualified audit opinion on its financial statements and made progress in resolving other issues associated with its annual independent audit. This represents a significant milestone in the Board's efforts to fully comply with financial management laws and practices.

Appendix A: Recommendations Cited

Number	Date	Title
94-1	May 26, 1994	Improved Schedule for Remediation in the Defense Nuclear Facilities Complex
95-2	October 11, 1995	Safety Management
97-2	May 19, 1997	Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy
98-2	September 30, 1998	Safety Management at the Pantex Plant
2000-1	January 14, 2000	Prioritization for Stabilizing Nuclear Materials
2000-2	March 8, 2000	Configuration Management, Vital Safety Systems
2001-1	March 23, 2001	High-Level Waste Management at the Savannah River Site
2002-1	September 23, 2002	Quality Assurance for Safety-Related Software
2002-2	October 3, 2002	Weapons Laboratory Support of the Defense Nuclear Complex
2002-3	December 11, 2002	Requirements for the Design, Implementation, and Maintenance of Administrative Controls
2004-1	May 21, 2004	Oversight of Complex, High-Hazard Nuclear Operations
2004-2	December 7, 2004	Active Confinement Systems
2005-1	March 10, 2005	Nuclear Material Packaging

Appendix B: 2006 Reporting Requirements

Date	Site or Topic	Response	Due
January 5	K-Basins at Hanford	Briefing	90 days
January 17	Work Planning at Oak Ridge	Briefing	--
March 3	DOE Oversight Policies	Report	90 days
March 27	Criticality Experiments	Report	60 days
March 27	Vital Safety Systems	Report	60 days
April 24	Rec. 2005-1 Repackaging Methodology	Report	30 days
May 1	Comments on DOE Manual 441.1	Report	30 days
June 19	NNSA plans for G-Tunnel	Report	60 days
June 26	DOE Standard 1027	Report	120 days
June 28	Nuclear Criticality Safety	Report	90 days
August 15	DOE Order 226.1	Report	30 days
September 22	Critical Experiments Facility	Report	--
September 22	Criticality Safety at Los Alamos	Report	45 days

Appendix C: Correspondence in 2006

Hanford Site

September 7 letter to the Assistant Secretary for Environmental Management on structural issues in the Waste Treatment and Immobilization Plant.

April 24 letter to the Assistant Secretary for Environmental Management on review of the implementation of activity-level work control by Fluor Hanford, Inc.

January 5 letter to the Secretary of Energy imposing a 90-day reporting requirement on sludge stabilization and packaging at the K-Basins.

Lawrence Livermore National Laboratory

October 11 letter to the Administrator, NNSA, regarding the Board's review of the nuclear criticality safety program.

May 10 letter to the Administrator, NNSA, on the development of the authorization basis documentation for the Plutonium Facility.

Los Alamos National Laboratory

September 22 letter to the Secretary of Energy imposing a 45-day reporting requirement on the site's nuclear criticality safety program.

Nevada Test Site

September 22 letter to the Administrator, NNSA, imposing a reporting requirement, the report to be submitted when the Critical Decision-3 package is submitted, describing how previously identified safety-related issues are being addressed at the Critical Experiments Facility.

August 16 letter to the Deputy Administrator for Defense Programs, NNSA, on building leaks and structural cracks in the Device Assembly Facility.

June 19 letter to the Administrator, NNSA, imposing a 60-day reporting requirement to describe plans for staging, assessing, and disposing of a damaged nuclear weapon or improvised nuclear device at the G-Tunnel.

March 27 letter of the Administrator, NNSA, imposing a 60-day reporting requirement on the issues pertaining to the Critical Experiments Facility.

Pantex Plant

December 15 letter to the Deputy Administrator for Defense Programs, NNSA, requesting a completion date for the Final Assessment Report on the implementation plan for Recommendation 98-2.

August 9 letter to the Deputy Administrator for Defense Programs, NNSA, on the restart of W88 cell operations.

March 27 letter to the Administrator, NNSA, on formal conduct of operations.

Savannah River Site

September 26 letter to the Administrator, NNSA, on surface settlement profiles for the Pit Disassembly and Conversion Facility.

July 12 letter to Secretary of Energy forwarding a copy of the Board's Third Annual Report to Congress on Plutonium Storage at DOE's Savannah River Site.

March 3 letter to the Secretary of Energy imposing a 90-day reporting requirement on the plans for implementing DOE Policy 226.1 and DOE Order 226.1.

Oak Ridge National Laboratory, Y-12 National Security Complex

February 28 letter to the Administrator, NNSA, on the documented safety analysis for the 9212 Complex at Y-12.

January 17 letter to the Assistant Secretary for Environmental Management imposing a reporting requirement for a briefing on the steps planned to ensure worker protection during Tank W-1A soil characterization.

Other Correspondence

November 21 letter to the Secretary of Energy accepting the revised implementation plan for Recommendation 2004-1 and closing Recommendation 95-2.

August 21 letter to the Deputy Secretary of Energy on observations from the Board's second public hearing on the integration of safety into design.

August 16 letter to the Administrator, NNSA, on the resolution of issues regarding DOE-STD-3016-2006.

August 15 letter to the Secretary of Energy imposing a 30-day reporting requirement to provide the previously requested plans for implementing the safety requirements in DOE Order 226.1.

August 15 letter to the Secretary of Energy requesting revision and re-submission of the implementation plan for Recommendation 2004-2.

June 28 letter to the Deputy Secretary of Energy imposing a 90-day reporting requirement regarding DOE's nuclear criticality safety program.

June 26 letter to the Secretary of Energy on the reorganization of DOE's Office of Environment, Safety and Health.

June 26 letter to the Acting Assistant Secretary for Environment, Safety and Health imposing a 120-day reporting requirement to address issues associated with DOE-STD-1027-92.

May 1 letter to the Acting Assistant Secretary for Environment, Safety and Health establishing a 30-day reporting requirement to respond to the Board's comments on Draft DOE Manual 441.1, *Nuclear Material Packaging Manual.*

April 24 letter to the Secretary of Energy imposing a 30-day reporting requirement to address comments on the Draft Repackaging Prioritization Methodology for Recommendation 2005-1.

March 27 letter to the Secretary of Energy imposing a 60-day reporting requirement on vital safety systems.

January 20 letter to Secretary of Energy transmitting DNFSB/TECH-36, *Integrated Safety Management: The Foundation for an Effective Safety Culture.*