SIXTEENTH ANNUAL REPORT

TO CONGRESS

DEFENSE NUCLEAR FACILITIES
SAFETY BOARD

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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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To the Congress of the United States:

The Defense Nuclear Facilities Safety Board is pleased to submit to Congress its Sixteenth 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 2005, assesses improvements in the safety of defense nuclear facilities, and identifies remaining health and safety problems.

Respectfully submitted,

A.J. Eggenberger
Chairman

Joseph F. Bader
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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 must consider the technical and economic feasibility of implementing the recommended measures. The Secretary may accept in whole or in part or reject the recommendations. If the Secretary rejects a recommendation in whole or in part for any reason, the Board does not withdraw or modify the recommendation, and the Secretary maintains the rejection, the Secretary's decision and reasoning must be published in the *Federal Register* and provided to both Houses of Congress. The Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary considerations. Should the Board determine that an imminent or severe threat to public health or safety exists, the Board must transmit its recommendation to the President and the Secretaries of Energy and Defense.

In addition to issuing recommendations, the Board may conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, and take other actions such as establishing reporting requirements. Requests for detailed reports on safety issues have generally resulted in prompt remedial actions by DOE.

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.

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Summary of Accomplishments in 2005

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; 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 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 tritium; and research, development, manufacturing, and testing.

As a result of the Board's efforts during 2005, 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 as follows.

Multiple Sites:

- In support of nuclear explosive operations at the Pantex Plant, DOE has improved the weapons laboratories' use of tests and modeling for mechanical impact.

- The Board issued and DOE accepted Recommendation 2005-1, *Nuclear Material Packaging* (reprinted in Appendix A). The principal goal of this recommendation is to ensure that packaging of nuclear material at sites with ongoing missions meets technically defensible criteria for safe storage and handling.

Pantex Plant:

- DOE completed repackaging the backlog of surplus pits that were the focus of the Board's Recommendation 99-1. The pits are now stored in containers capable of maintaining a benign environment for up to 50 years.

- As part of its implementation plan for Recommendation 98-2, DOE has implemented all of the technical safety requirements that support the onsite transportation of nuclear and hazardous materials.

- DOE is carrying out near- and long-term plans to improve conduct of operations.

- DOE has made substantial improvements in the special tooling program for nuclear explosive operations.

Y-12 National Security Complex:

- DOE is enhancing the earthquake resistance of Building 9212.

- DOE completed installation and activation of a new fire suppression system and other engineered fire safety upgrades in a key uranium processing area.

- DOE completed thermal imaging and evaluation of all electrical panels and is taking action to repair or replace them as appropriate, reducing the risk of fire.

Los Alamos National Laboratory:

- Prior to issuing the request for proposal for engaging a new management and operating contractor, DOE revised the request based on the Board's objection to proposed terms that would have placed inadvisable limits on the government's right to inspect and oversee activities of the contractor.

- DOE is examining deficiencies in confinement ventilation at the Plutonium Facility.

- DOE has implemented an effective process for validating the completeness and sustainability of corrective actions designed to correct findings identified during the laboratory-wide suspension of work in 2004.

- DOE has significantly improved conduct of engineering at the laboratory.

Lawrence Livermore National Laboratory:

- DOE was able to resume operations in the Plutonium Facility after ensuring that adverse findings by the Board and DOE's Office of Independent Oversight had been investigated and procedures revised as needed for safe operations.

- DOE strengthened conduct of operations and confirmed the operability of vital safety systems in the Plutonium Facility.

- DOE developed a schedule to improve the configuration management program for vital safety systems.

Nevada Test Site:

- DOE is characterizing cracking in the concrete structure of the Device Assembly Facility and taking corrective actions, including mapping the cracks, collecting data on the construction of the facility to assess the significance of the cracks and structural capability of the facility, and developing a plan to prevent rainwater infiltration.

- DOE continued to make improvements in the facilities and processes necessary to dispose of a damaged nuclear weapon.

- DOE is performing rigorous reviews of the safety bases for subcritical experiments.

Sandia National Laboratories:

- DOE is correcting deficiencies in safety analyses and remediating significant shortfalls in the site's integrated safety management system.

Nuclear Materials Processing and Stabilization

The Board's strategic performance goal for this area calls for the Board to review and assess the safety of DOE's efforts to stabilize remnant materials from past weapons production. The effort also includes oversight of the packaging, storing, and disposing of these excess materials. Materials that fall within the scope of these reviews include inactive actinide materials at NNSA sites, high-level wastes, low-level wastes, transuranic wastes, and spent nuclear fuels. The Board also provides oversight of the decontamination and decommissioning of related defense nuclear facilities.

The Board's oversight of the processing of nuclear materials has resulted in several safety improvements at DOE facilities. These improvements include completing the processing and stabilization of many hazardous materials cited in the Board's Recommendations 94-1 and 2000-1. DOE has also taken action to improve conduct of operations, readiness preparations, and work planning for deactivation and decommissioning work.

Specific examples of safety improvements in materials processing and stabilization made in consequence of the Board's work are as follows.

Savannah River Site:

- DOE provided better controls and a more rigorous readiness review to ensure that the retrieval of waste from Tank 5 proceeds safely.

- When the Board pointed out the potential for an uncontrolled explosion hazard in transuranic waste drums, DOE halted operations, analyzed the hazard, and implemented new safety controls for drum handling.

- DOE completed stabilizing all remaining plutonium and uranium materials at Savannah River Site that were included in the implementation plan for the Board's Recommendations 94-1 and 2000-1.

- When the Board identified weaknesses in the controls used to ensure neptunium oxide purity for safe storage, DOE restabilized the suspect material and enhanced process controls and verification sampling for product quality.

Hanford Site:

- DOE safely removed 12 drums containing plutonium oxides from a burial trench.

- In light of new information regarding corrosion in high-level waste tanks, the Board requested a detailed review of the corrosion program at the Tank Farm; DOE used the review to strengthen the program.

- DOE enhanced the criticality safety program at the Plutonium Finishing Plant by improving the accuracy and reliability of the nondestructive assay program (which measures the mass of holdup fissile material).

Rocky Flats Closure Project:

- DOE completed ahead of schedule the clean up of the Rocky Flats site in October 2005.

Fernald Closure Project:

- DOE corrected several deficiencies identified by the Board in the site's preparations for treatment of uranium wastes in silos.

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 the 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 in excess of $13 billion. The Board continues to devote extensive resources

ensuring that designs for defense nuclear facilities incorporate multiple layers of safety controls commensurate with the hazards presented.

During the past year, the Board concluded that DOE was failing to establish a conservative design early in the design process. Moreover, in addition to an increasing number of new projects, DOE planned to make use of "design-build" techniques for large-scale facilities, including some that will house incompletely-designed, hazardous processes. 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 held a public hearing in December 2005 on "Incorporating Safety into Design and Construction." This hearing is the first in a series to investigate DOE's program for ensuring the safe design and construction of nuclear facilities and to focus on processes for identification and resolution of safety issues early in the design effort.

Specific examples of safety improvements in design and infrastructure made as a result of the Board's work are as follows.

Hanford Site:

- DOE identified and is correcting potential safety flaws in the design of the Waste Treatment Plant. Improvements were made in safety basis calculations, coating of structural steel for fire resistance, design bases for mitigation systems used to prevent hydrogen deflagrations and detonations, concrete quality, and calculation of seismic loads.

- DOE is correcting deficiencies in the confinement of radioactive materials and in worker protection for the Demonstration Bulk Vitrification Project.

Savannah River Site:

- DOE revised the performance categorization of the Salt Waste Processing Facility to ensure adequate confinement of hazardous materials.

- DOE made improvements in the design methodology used to assess safety margins in the building foundation for the Pit Disassembly and Conversion Facility.

Y-12 National Security Complex:

- For the Highly Enriched Uranium Materials Facility, DOE is correcting weaknesses identified by the Board in quality assurance and control practices for concrete placement in the foundation and building walls.

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 health and safety of the workers and the public. The Board's

oversight activities in this area focus on generally applicable safety standards and on generic issues affecting a variety of defense nuclear facilities.

As a result of the Board's efforts during 2005, DOE has taken actions to strengthen the technical competence of its contractors and federal employees, establish and implement safety standards, and improve the quality of engineered systems. DOE has also taken measures to enhance the effectiveness of oversight and integrated safety management, using attributes derived from high-reliability organizations and from lessons learned in the loss of the Columbia Space Shuttle and the near-miss event at the Davis-Besse Nuclear Power Plant.

Specific examples of improvements in nuclear safety programs and analysis made in consequence of the Board's work are as follows.

- DOE strengthened its fundamental policies for oversight of complex, high-hazard nuclear operations and issued new directives for the complex. (Recommendation 2004-1)

- DOE restructured line management to align it more closely with the attributes of a highly reliable organization. (Recommendation 2004-1)

- DOE developed and provided training to all field elements on the standards and expectations associated with Specific Administrative Controls. (Recommendation 2002-3)

- DOE finalized a field review aimed at verifying the adequacy and effectiveness of the implementation of Specific Administrative Controls. (Recommendation 2002-3)

- DOE developed and conducted a training course for safety professionals, senior managers, and decision-makers responsible for nuclear safety and oversight. (Recommendation 2004-1)

- DOE completed a guidance document on work planning and control processes that also includes criteria and review approaches to assess these processes comprehensively. (Recommendation 2004-1)

- DOE committed to evaluating confinement ventilation approaches and, where appropriate, to shifting to reliance on active rather than passive systems. (Recommendation 2004-2)

- DOE committed to develop a new policy governing the use of risk assessment and risk management at defense nuclear facilities.

Outstanding Safety Problems of Defense Nuclear Facilities

Technical Capacity and Highly Reliable Organizations

Information developed by the Columbia Accident Investigation Board with respect to the loss of the space shuttle, and by the Nuclear Regulatory Commission in connection with the "near miss" at the Davis-Besse Nuclear Power Plant, suggests that a weakening of federal oversight of contractor operations can have dire consequences. Unfortunately, lessening of federal oversight has been an objective of DOE's senior management. To examine the hazards of this course of action more fully, the Board completed a series of eight public hearings between September 2003 and March 2004. During the public hearings, the Board received testimony from representatives of the Nuclear Regulatory Commission, the Naval Reactors Program, the Columbia Accident Investigation Board, and DOE managers.

Based on its review in this area, the Board concluded that DOE's reduced-oversight initiatives could increase the possibility of a nuclear accident in the defense nuclear complex. In particular, the Board saw evidence of (1) increased emphasis on productivity at the expense of safety, (2) loss of technical competence in DOE upper management, (3) insufficient safety research, and (4) inadequate central oversight of safety. To reset DOE's course of action, the Board issued Recommendation 2004-1 in May 2004. The recommendation is supported by a technical report entitled *Safety Management of Complex, High-Hazard Organizations*, DNFSB/TECH-35.

Execution of DOE's ambitious implementation plan for this recommendation will require at least two more years to reach fruition. DOE has created two fledgling Central Technical Authority positions and has established a nuclear safety research function. DOE has also issued two directives on federal oversight. The Board will be working closely with DOE throughout the next two years to put in place the detailed requirements on oversight and integrated safety management that are necessary to sustain a safe and successful defense nuclear complex.

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." The term "integrated" is used to indicate that all aspects of safety and work planning and performance are integrated into a single process under the responsibility of line 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 a wide range of hazards: nuclear, chemical, and physical. The identification of hazards and development of protective measures should be carried out in an integrated way.

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. However, it was recognized at the time that full implementation of integrated

safety management was not yet a reality complex-wide. Since then, implementation has faltered. In Recommendation 2004-1, the Board identified the need to reinvigorate integrated safety management through rigorous attention, with technical and operational excellence based on nuclear safety standards subject to rigorous oversight. DOE's implementation plan of June 2005 contains three major thrusts—one of which directly addresses integrated safety management. The Board also conducted an extended, in-depth evaluation of integrated safety management at each of the major NNSA sites, identifying cross-cutting issues as a means of targeting the revitalization efforts. The results of this evaluation were published early in January 2006 as DNFSB/TECH-36, *Integrated Safety Management: The Foundation for an Effective Safety Culture*. Overseeing the execution of DOE's implementation plan, plus additional actions devised to address the findings of the technical report, will continue to be a major focus of the Board's work in 2006.

Reliable Operation of Safety Systems

As in previous years, the Board remains interested in ensuring that DOE properly maintains safety systems at defense nuclear facilities. Many defense nuclear facilities were constructed decades ago. It is often difficult, but important, that protective features 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, prevention 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 and to provide less effective maintenance. 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.

Recommendation 2004-2 will require significant effort in this regard in the immediate future. DOE completed development of the implementation plan in August 2005. Under this plan, DOE (and the Board) will be reviewing the confinement strategy of all new and existing Hazard Category 2 and 3 defense nuclear facilities to ensure that they meet DOE's expectations. Priority will be given to new facilities or major modifications, but all facilities will be reviewed to ensure that they do not rely on building integrity to mitigate the consequences of an event if such strategy cannot be justified. To date, DOE has identified more than a dozen facilities that may need potential upgrades to ventilation systems.

Adequacy of Design for New Defense Nuclear Facilities

One of the Board's statutory responsibilities is to ensure that adequate health and safety requirements are embedded in the design of new defense nuclear facilities and are properly implemented during construction. Needed safety controls must be identified early in the design

process to avoid unnecessary increases in cost and construction delays. Integrated safety management provides the framework for the identification and application of safety requirements in design and construction. The Board expects that when DOE initiates a project to build a new defense nuclear facility, which may need to operate for as long as 50 years, integrated safety management principles and core functions will be used in all phases of the project.

There have been several recent instances where an appropriate level of safety was not initially designed into new defense nuclear facilities. These projects reached advanced stages of design without adequate consideration of design features and engineered controls, even though project personnel believed they were following closely DOE's design directives. For example, the Board was particularly concerned with the performance categorization of one new facility, where the existing DOE directives appeared to allow a high hazard facility (Hazard Category 2) to be designated as a lower design level (Performance Category 2) facility.

The Board has requested that DOE make changes to the appropriate DOE directives to address this concern. The design performance category specified for a high-hazard facility must be the higher-level performance category (Category 3) if confinement of material is needed to protect site or facility workers. DOE has agreed to this request and has proposed changes to the applicable DOE directives. The Board believes that further improvement in the incorporation of safety in design of new defense nuclear facilities may be possible and convened a public hearing in December 2005 to investigate DOE's expectations and methodologies for incorporating safety into design of defense nuclear facilities and potential areas for improvement. Further public hearings will be convened in 2006 to continue the investigation in this arena.

Safe Retrieval, Handling, and Stabilization of Nuclear Materials

DOE continues to struggle with technical and programmatic difficulties at the K-Basins Closure Project at Hanford. The Board uncovered programmatic breakdowns in engineering and project management that have substantially delayed efforts to retrieve sludge from the basins. By the end of 2005, DOE had approved a revised implementation plan to modify the milestones and deliverables that address the sludge milestones associated with the Board's Recommendations 94-1 and 2000-1. DOE rescheduled several milestones leading to the removal and packaging of sludge and moved the planned completion date from April 2007 to November 2009. The Board intends to continue to give high priority to continued close oversight of this effort.

The high-level waste program at Savannah River Site also presents numerous challenges and uncertainties for DOE. DOE persists in not considering the operation of the high level waste system as a tightly-coupled, integrated system with diminishing operational margins. These include limited tank space in useable high-level waste tanks, lack of salt processing capability, less-than-reliable performance of some evaporators, and the fact that one of the former In-Tank Precipitation tanks (Tank 48) has remained out of service seven years after the suspension of that project. In 2005, the Board worked with representatives of DOE while they revised the implementation plan for Recommendation 2001-1. The purpose of the revision is to update the milestones to reflect the current strategy and place renewed emphasis on addressing these long-standing high-level waste issues. The Board will continue to push DOE to take meaningful

action to begin processing salt waste and recover tank space, and reduce these significant hazards to the workers and the public.

Recommendation 2005-1. In March 2005, the Board issued Recommendation 2005-1, *Nuclear Material Packaging*. This recommendation advised DOE to (1) issue a requirement that nuclear material packaging meet technically defensible criteria for safe storage and handling, (2) identify which nuclear materials should be included in the scope, and (3) prioritize implementation of the improved nuclear material packaging requirement. By August 2005, DOE had developed an acceptable implementation plan; by the end of 2005 DOE had already met the first five deliverables and commitments due under the plan. The Board will continue to work with DOE throughout 2006 to successfully execute the remainder of the implementation plan.

Vigilance During Deactivation and Decommissioning

DOE has begun deactivating and decommissioning many nuclear facilities that have completed their missions in the nuclear weapons complex. The Board has been monitoring this growing decommissioning effort at the Hanford Site, Savannah River Site, Idaho National Laboratory, Fernald Closure Project, and the Miamisburg Closure Project. The Board has noted several challenges that face DOE and its contractors.

First, although the potential for an inadvertent criticality accident during deactivation and decommissioning of DOE's nuclear facilities is small, the consequences would be very large. Nevertheless, there is a tendency for facility personnel to prematurely relax criticality safety vigilance once bulk quantities of radioactive materials have been removed from a facility. Second, a significant number of fires have occurred during deactivation and decommissioning of nuclear facilities. Although most fires have been extinguished with little or no spread of radioactive materials, the potential exists for the spread of contamination and for significant radiological exposure to workers due to a fire. Third, work planning and safe execution of deactivation and decommissioning work is a concern. The shift from production operations to decommissioning work involves new tasks and changing facility conditions. The magnitude of the effort required for decommissioning work has not always been recognized, and work has been started while plans remained incomplete and hazard evaluations remained inadequate.

DOE has not always retained an adequate force of competent staff due to cost considerations. This has been a particular concern to the Board in areas such as the retention of acceptable numbers of experienced radiological control technicians and criticality experts—both areas of high concern when substantial amounts of radioactive and special nuclear materials remain in place. The Board will continue to review deactivation and decommissioning efforts closely until DOE can demonstrate an improved capability to plan and execute such activities.

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 the 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, and 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 oversight of DOE's defense nuclear weapons facilities and operations. For that reason, members of the Board are required by statute to be 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 Washington State, 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 16 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 activities are closely tied to goals and objectives embodied in this plan.

This Annual Report summarizes the Board's work during calendar year 2005. 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 reprints Recommendation 2005-1, Appendix B lists all recommendations cited in this report, Appendix C lists all reporting requirements imposed on DOE in 2005, and Appendix D contains a full list of the Board's 2005 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 the 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 obtain and maintain 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 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 171 reporting requirement letters. In 2005 alone, the Board issued 25 such letters to DOE.

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 the following:

- 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 threats, 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 the 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 the 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 the 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 2005, the Board sought health and safety improvements in weapons operations, onsite transportation operations, tooling program implementation, facility safety systems, and electrical and lightning protection systems.

Safety Management. DOE's implementation plan for Recommendation 98-2 includes commitments to improve the safety of nuclear explosive operations and to implement safety controls for onsite transportation of nuclear material. Satisfactory completion of these commitments has been delayed. Senior DOE management's obligation to provide monthly status briefings to the Board has focused management attention on the completion of these commitments. In November 2005, the Pantex Site Office reported the completion of readiness reviews to validate the implementation of all technical safety requirements for onsite transportation of nuclear and hazardous materials.

The implementation plan for Recommendation 98-2 also includes a commitment to formalize and improve the process for analyzing weapons responses to potential accident environments. DOE's draft document submitted to the Board in October 2005 failed to establish consistent criteria for evaluating and documenting weapons responses. In a December 2005 letter, the Board identified the key deficiencies and requested that DOE report on how it planned to proceed.

Conduct of Operations. Continuing deficiencies in the conduct of operations at Pantex led the Board to send a letter to DOE on May 2, 2005, identifying operational issues and requesting a briefing on plans to improve this critical area. In a briefing to the Board on May 25, 2005, DOE outlined improvements it planned to make in (1) training of first-line supervisors and production technicians, (2) metrics for performance monitoring, and (3) upgrading the conduct of operations manual and work procedures. A followup review by the Board later in the year revealed that progress had been made, but more time is needed to see if the corrective actions have staying power.

Electrical and Lightning Protection. DOE has improved electrical and lightning protection systems at Pantex by installing surge suppression capability in defense nuclear facilities. The Board is also encouraged that the electrical safety committee has been re-established. In a November 2004 letter, the Board reported problems in low-voltage testing used to characterize the lightning response of nuclear explosive facilities. During an electrical review

conducted by the Board in November 2005, DOE revealed plans to eliminate such testing because of the difficulty in obtaining repeatable results. The Board did not accept this position and has suggested that DOE work harder to find a suitable test protocol.

Safe Storage of Pits. During 2005, DOE completed repackaging the backlog of pits that were the subject of Recommendation 99-1. The pits are now stored in containers capable of maintaining a benign environment for up to 50 years. A surveillance program has been established to monitor the repackaged pits in storage, and a process is being established to place future accumulations of pits into sealed containers for long-term storage. Based on these accomplishments, the Board closed Recommendation 99-1 in a September 9, 2005 letter.

Special Tooling Program. The special tooling program plays a vital role in the overall safety of nuclear explosive operations at Pantex. During 2005, in response to issues raised by the Board in 2004, DOE pursued improvements to the tooling program. These efforts have produced improvements in the overall tooling program, including both quality and availability of special tools. A new plant standard was published that better defines the overall tooling program responsibilities and interfaces. Tool receiving, repair, storage, and maintenance facilities have been upgraded, and new equipment items, computers, fabrication machines, inspection instruments, and associated hardware have been purchased to enhance the tooling program's capabilities. The Board observed a tooling review performed by DOE in September 2005 and agreed with the review team's conclusion that the program has improved significantly.

Weapons Laboratory Support. In response to Recommendation 2002-2, DOE enhanced the process for communicating and resolving safety issues between the weapons laboratories and the production sites. In a November 2005 letter, the Board accepted DOE's proposal to close this recommendation.

Nuclear Explosive Safety Review. In response to a commitment made to the Board in March 2005, DOE conducted a 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. Approximately 40 representatives from the Board, NNSA Headquarters and Service Center, the weapons laboratories, Pantex and Nevada Site Offices and their respective contractors, and the Office of the Chief of Defense Nuclear Safety, participated in a series of meetings.

The results of these meetings were documented in a draft report reviewed by the Board in December 2005. The top-down review identified deficiencies in both requirements and in the implementation of requirements. DOE plans to revise its nuclear explosive safety directives to correct deficiencies in requirements. The Board is continuing to pursue several additional improvements proposed during the top-down review that DOE does not currently plan to implement.

Seamless Safety for the 21st Century. Implementation of this process for the B83 weapon system, originally scheduled for May 2002, remains significantly behind schedule. Although the Nuclear Explosive Safety Study began in February 2005, B83 operations at Pantex using Seamless Safety likely will not begin until late 2006. The Board is now reviewing work by

the weapons laboratories to address pre-start findings identified during the Nuclear Explosive Safety Study.

2.1.2 Y-12 National Security Complex

Y-12 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, fire protection, electrical safety, and the safety of several new or modified processing capabilities.

Seismic Deficiencies. The "9212 Complex" at Y-12 is a collection of structures built between 1948 and 1958 for processing highly enriched uranium. While updating the complex's safety basis, DOE found numerous seismic deficiencies, including missing or loose bolts, missing or structurally inadequate braces, inadequate beam supports, and designs that are deficient when measured by current criteria. In these aging structures, glass sections in tall columns and sight glasses are vulnerable to breakage, cans and storage racks are not adequately secured, and horizontal and vertical tanks are not adequately supported.

In a letter dated April 20, 2005, the Board suggested that DOE pursue a balanced plan for constructing a new facility for uranium processing, and in the interim, reducing material-at-risk and implementing practical facility modifications. In response, DOE has developed a phased approach: first, repair deficiencies attributable to faulty maintenance, and second, evaluate the need for seismic upgrades. For the evaluation, DOE planned to use a risk-based methodology to prioritize upgrades and make implementation decisions on an annual basis. The Board concluded that such an approach might well lead to a series of short-term decisions to accept existing deficiencies. In a letter dated November 28, 2005, the Board requested that DOE link decisions on upgrades to the existing facility with achievement of specific milestones in the design and construction of the new processing facility.

Fire Protection, Building 9212. In 2002, the Board challenged the adequacy of fire protection in the B-1 wing of Building 9212 that included a wet chemistry process area without a fire suppression system. In July 2004, DOE decided to install a fire suppression system on the first floor, a new shutdown interlock for the process system, fire-protective coatings on certain structural supports, and modifications to divert combustible liquids to the first floor. In 2005, DOE completed installation and activation of the new fire suppression system and the other engineered fire safety upgrades.

Site-Wide Fire Protection. In addition to the installation of a new fire suppression system in Building 9212, DOE continued work under a 10-year comprehensive improvement plan for fire protection at Y-12. Significant progress has been made in many facets of fire protection such as maintenance of systems, analysis of fire hazards, and inspection of fire barriers.

Electrical Safety. As a result of a small electrical fire in Building 9212 in 2003, DOE initiated a corrective action plan that included thermal imaging and evaluation of all Y-12 electrical panels. Initial inspections determined that more intrusive inspections were required for

some of the panels. In a letter dated June 22, 2005, the Board noted that these inspections were being delayed and urged DOE to complete them in a timely manner. DOE then applied additional resources and completed the intrusive inspections, which uncovered several problems. Appropriate actions are being taken to repair or replace the deficient panels.

Quality Evaluation Capability. In 2005, the Board reviewed DOE's efforts to relocate the quality evaluation capability for examination of returned nuclear weapons components, a critical national security mission at Y-12. The Board examined the preparations for the critical lift of a key glovebox associated with this project. In addition, the Board noted that DOE appropriately directed the contractor to develop a Preliminary Documented Safety Analysis for the project.

Safety Basis Controls. In 2003, the Board highlighted the lack of a process to ensure implementation of new or revised safety basis controls. In response, DOE instituted independent validation protocols at Y-12. Initial reviews conducted in 2004 revealed the need for several enhancements in protocols and personnel training. In 2005, DOE completed a baseline series of reviews in most of the site's nuclear facilities. The Board noted that such reviews may be needed on a periodic basis to ensure continued implementation of safety controls. In response, DOE revised procedures to require comprehensive independent validation every three years.

Reduction Process. In 1999, the Board found safety deficiencies in the design and structural integrity of the reactor vessel used to reduce uranium tetrafluoride to metal. These vessels are subject to significant internal pressures and temperature gradients, but had not been designed to meet the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. In response, DOE started a limited test program using vessels of the existing design to support design of a new, code-compliant vessel. The new reactor vessel is made of stronger material and incorporates new pressure sensing and relief capabilities. In early 2005, DOE completed testing and in September started using the new vessel for producing uranium metal.

Nondestructive Assay. Following the August 2005 discovery that the Y-12 contractor had significantly underestimated the uranium hold-up associated with a process filter in Building 9212, the Board reviewed the site's programs for performing nondestructive assays. In response to the Board's review, DOE is improving the techniques for accurately identifying uranium hold-up, including uncertainty evaluation and the formality of communicating and responding to hold-up estimates to ensure criticality safety.

Criticality Safety. The Board, as well as DOE, noted a series of criticality safety issues at several Y-12 facilities in February 2005. In particular, at the main uranium storage facility, numerous containers had been received and stored on separate occasions with contents exceeding criticality safety mass limits. The Board's review of these events found that personnel performance and conduct of operations failures were major factors, but these factors had not been fully addressed by initial corrective actions. To correct this deficiency, DOE requested that the contractor perform a full evaluation of failures in conduct of operations.

2.1.3 Nuclear Material Packaging

Recommendation 2005-1. On March 10, 2005, the Board issued Recommendation 2005-1, *Nuclear Material Packaging*. (The Recommendation is reprinted in its entirety in Appendix A.) This recommendation advised DOE to (1) issue a requirement that nuclear material packaging meet technically defensible criteria for safe storage and handling, (2) identify which nuclear materials should be included in the scope and then determine the technically-justified handling and storage criteria, and (3) prioritize implementation of the improved nuclear material packaging requirement consistent with the material hazards and the risk posed by the existing packages. On May 6, 2005, DOE accepted the recommendation, and on August 17, 2005, submitted an implementation plan which the Board accepted on September 13, 2005. DOE has met the first five deliverables and commitments due thus far under this plan.

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 2005, the Board focused its attention on resumption of operations, active confinement ventilation, work planning, conduct of engineering, fire protection, and oversight by the Los Alamos Site Office.

Resumption of Work. The Board reviewed the resumption of laboratory operations and corrective action plans following the 2004 suspension of work. Early in 2005, the Board provided continual feedback to the laboratory about its process for verifying that corrective actions completely addressed the intended issues and were sustainable. These discussions contributed to the laboratory's decision to establish a formal Corrective Action Review Board, the primary mechanism for ensuring that corrective actions captured in the Operational Efficiency Project are likely to be effective. In a letter to DOE dated July 21, 2005, the Board noted that full implementation of the Operational Efficiency project is critical and will require the dedication of significant resources for several years. The Board encouraged DOE to make adequate resources available for all needed corrective actions at the laboratory. The Board remains concerned that DOE ensure corrective actions, once initiated, are sustained.

Confinement Ventilation, Plutonium Facility. The Plutonium Facility is a high-hazard facility with a long expected operating life. Several postulated accident scenarios have unmitigated consequences that exceed the 25 rem offsite evaluation guideline; therefore, the Plutonium Facility needs safety-class controls. The current safety basis credits a passive confinement strategy as a safety-class mitigative control to address these scenarios. The Board previously questioned the capability of passive confinement strategies to adequately limit

potential releases from the Plutonium Facility. In a letter to DOE dated May 31, 2005, the Board noted that an active confinement ventilation system is a preferable safety class control. This issue is to be resolved as part of DOE's response to Recommendation 2004-2.

Fire Protection. The Board reviewed the fire protection program and concluded that while the laboratory and DOE had increased their attention to fire protection and taken some appropriate actions, resolution of issues had been piecemeal. Issues that had languished for years included (1) incomplete documentation and delays in the completion of inspections, tests, and maintenance, (2) recommendations of fire hazard analyses not implemented on a timely basis, (3) no formal plan to address the Baseline Needs Assessment for fire and emergency services, (4) no long-term contract for fire and emergency services with Los Alamos County, and (5) fire alarm systems in several defense nuclear facilities still requiring upgrades. The Board has requested that DOE define a multi-year strategy for timely resolution of all fire protection deficiencies and achievement of site-wide improvements.

Processing of Plutonium-238. In preparation for near-term startup, the Board continued to evaluate the safety of the full-scale aqueous processing line for plutonium-238. The Board observed that the laboratory had not adequately resolved some previously identified issues, such as flammability hazards posed by generation of hydrogen gas in process equipment. The laboratory subsequently committed to strengthen the technical bases and add necessary safety controls. The Board is awaiting the results of additional evaluations of the adequacy of existing safety controls and potential modifications to process equipment.

Operations in Technical Area 18. In a letter dated May 21, 2004, the Board observed that the unmitigated consequences for postulated worst-case nuclear accidents at this facility were quite high and are fundamentally different from worst-case scenarios at other laboratory facilities. A sequence of operator errors could initiate an uncontrolled reactivity excursion leading to melting and partial vaporization of a metallic plutonium core or sample. During 2005, DOE curtailed the types of experiments having even a remote potential for melting plutonium. Most special nuclear materials now have been removed from Technical Area 18.

Request for Proposal. On December 1, 2004, DOE issued a draft request for proposal for the management and operation of the laboratory. The Board's review of the proposal found that it placed unnecessary and ill-advised limitations on DOE's right to inspect and oversee the activities of the contractor, undermined DOE's system for identifying and implementing safety requirements, and omitted relevant safety requirements. The Board issued a letter to DOE on December 16, 2004, identifying these problems. The Board subsequently evaluated the final request for proposal and found that it strengthened DOE's ability to perform oversight without excessive contractual limitations.

Strategic Pause in Federal Oversight. In November 2005, the Board was briefed by DOE on a planned 3-month "strategic pause" at the Los Alamos Site Office. The purpose of the strategic pause was to reassign personnel in the site office to preparations for the transition to a new prime contractor. Approximately two-thirds of the site office's workforce was assigned to the transition effort, leaving the remaining third to perform essential functions and oversee laboratory operations. As a compensatory measure, the site office requested that the laboratory contractor increase its internal self-assessment activities for an indefinite period of time. In a

letter to DOE dated November 29, 2005, the Board challenged this retreat from federal oversight responsibility. The Board stated that executing a substantial reduction in federal oversight concurrent with a number of higher-risk laboratory activities was not consistent with ensuring safe operations. This is of particular concern as it is occurring during the first contractor transition period in Los Alamos's history—a period when oversight by the site office is most needed.

Conduct of Engineering. Prior to 2005, the Board had noted continued delays in the full implementation of DOE Order 420.1A, *Facility Safety*, which provides design requirements for nuclear facilities. The Board also observed that some of the more complex and higher-hazard research, development, demonstration, testing, and production work would benefit from a structured application of engineering standards and practices, a formal conceptual design phase similar to that for large facility projects, and design reviews following completion of conceptual and final designs. Los Alamos has now taken corrective actions to address most of these issues as part of the Operational Efficiency project.

Integrated Work Management. The Board reviewed progress in improving integrated work management as part of the Operational Efficiency project. Among the various subprojects, integrated work management has the greatest potential to improve worker safety. However, the Board found that the improvements are not fully and consistently implemented nor completely understood by the workforce. Consequently, not all senior managers and scientists fully support the initiative. Active engagement and support for the improvements by DOE has been minimal. While further improvements in integrated work management are desirable, changes must be carefully considered in terms of potential for acceptance by laboratory staff, particularly during the contract transition period. The need for continued attention by the site office and the laboratory staff to sustain improvements, once made, has been emphasized by the Board.

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 2005, the Board conducted reviews of integrated safety management, conduct of operations, configuration management of vital safety systems at the Superblock facilities, and the resumption of operations in the Plutonium Facility.

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 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. In July 2005, DOE briefed the Board on a generally acceptable path forward toward achieving and verifying

readiness to resume a limited scope of operations. DOE provided the details of this plan to the Board in a September 2005 letter.

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. 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. The review of the Plutonium Facility confirmed deficiencies in the application of configuration management but concluded that all of its vital safety systems were operable and capable of performing their safety functions. The Board is now evaluating DOE's plans for establishing configuration management for vital safety systems in all of the laboratory's defense nuclear facilities.

Verification of Plutonium Facility Readiness. The Board reviewed the adequacy of the readiness assessments performed by DOE and the laboratory for resumption of limited operations in the Plutonium Facility and was generally satisfied with DOE's progress. DOE authorized resumption of limited operations in the Plutonium Facility on October 10, 2005.

Deactivation of Building 251. The deactivation of Building 251 involves the removal of nearly 300 radioactive items, some posing a significant risk of radiation exposure to workers and potential for release of contamination in the building. The project is being carried out on an accelerated schedule to achieve near-term risk reduction and thus avoid costly safety basis upgrades. DOE completed the reduction of the nuclear material inventory in the facility to meet "Radiological Facility" criteria on April 10, 2005.

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, 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 2005, 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. 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 proved inefficacious 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 Device Assembly Facility's safety systems and management programs needed to ensure that the facility is ready for the increased scope of work. DOE is still working to respond to this request.

In a related matter, the Board evaluated the physical condition of the Device Assembly Facility, finding 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. In response, DOE has mapped the cracks and collected data on the construction of the facility to assess impacts on structural stability. DOE is also taking steps to plug the leaks.

Damaged Weapons. The Board continued to press DOE to develop a program and infrastructure to safely dispose of a damaged or improvised nuclear weapon. During 2005, the Board reviewed the condition of the proposed facility (G-tunnel) for handling such a device, including safety basis implementation, electrical safety, lightning protection, ground support, and seismic sensitivity. The Board also reviewed the formality of operations for disposition 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. As a result, DOE developed priorities for safety improvements and, according to those priorities, has continued to make physical improvements, improve disposition practices and procedures, and conduct training on device disposition activities. Progress remains slow.

Subcritical Experiments. The Board previously reviewed DOE's assessments and readiness for subcritical experiments and found inadequate nuclear safety management programs, inadequate mechanisms for verifying readiness, and inadequate commitment to improving the readiness review process for subcritical experiments and nuclear weapons testing. In 2005, the Board reviewed preparations for subcritical experiments, including safety bases, facilities at the U1a Complex and U6c Site, infrastructure improvements, and safety management programs. The Board observed that DOE's Nevada Site Office conducted a more rigorous safety basis review, which led to improved safety basis documents for subcritical experiments and a commitment to improve the implementation of controls and conduct of readiness reviews.

Safety Basis Reviews. The Board continued to review the safety bases for nuclear facilities and activities, including the Device Assembly Facility, the U1a Complex and subcritical experiments, the Radioactive Waste Management Complex, G-tunnel, and onsite transportation. Although the safety bases are improving substantially, in 2005 the Board identified deficiencies in submitted documented safety analyses and technical safety requirements, in classification of a facility, and in a Transportation Safety Document.

Lightning Protection and Electrical Systems. In 2003, the Board advised DOE that improvements in lightning protection and electrical systems were needed. The Board's review in 2004 found that lightning protection controls and features were now included in the safety basis of several nuclear facilities. The Board's review of lightning protection and electrical systems during 2005, sent to DOE on March 28, 2005, acknowledged many improvements. However, issues still remain including deficient uninterruptible power supply switches and oil-insulated transformers at the Device Assembly Facility, an antiquated ventilation system in G-tunnel, lack of a Faraday cage in G-tunnel, and absence of a site-wide lightning protection program.

2.2.4 Sandia National Laboratories

Sandia National Laboratories are located primarily in Albuquerque, New Mexico. Major defense nuclear facilities at Sandia, most of which are located at Technical Area V at the New Mexico site, include the Annular Core Research Reactor, Hot Cell Facility, Gamma Irradiation Facility, and Pulsed Reactor Facility. In September 2004, the Board issued a letter questioning the adequacy of safety bases at Sandia. Since then, DOE has been working to correct deficiencies identified in the documented safety analyses. Because all required corrective actions could not be completed prior to the planned restart of the Annular Core Research Reactor, a readiness review was conducted to permit operations in a reduced operating mode.

DOE has developed a corrective action plan to ensure that integrated safety management is fully implemented. The Board evaluated the corrective action plans during 2005 and will perform a follow-up review on the effectiveness of the corrective actions in 2006.

2.2.5 Research and Development for Explosives Safety

In April 2005, the Board reviewed research and development on explosives safety at the weapons laboratories. Such research includes testing and modeling results for mechanical impact and electrostatic discharge scenarios for nuclear explosive operations at Pantex. Lawrence Livermore and Los Alamos laboratories clarified and coordinated their use of laboratory test data and modeling for impact scenarios.

The weapons laboratories and Pantex personnel provided their periodic briefing to the Board on weapons safety research and development program priorities on September 21, 2005. Lightning effects on weapons, electrostatic discharge, and multi-unit processing were high on all prioritized lists. In a November 22, 2005 letter to DOE, the Board requested that an updated list of weapon-specific points of contact be provided to the Board at the periodic briefings on the status of laboratory research and development for weapons safety, to ensure that the laboratories continue to assign personnel with appropriate expertise to these positions.

3. Nuclear Materials Processing and Stabilization

3.1 Stabilization and Storage of Remnant Materials

3.1.1 Complex-Wide Program

Inactive Actinide Materials. DOE has chartered the Defense Programs Nuclear Materials Management Team to continue the work of the Inactive Actinide Working Group in managing non-programmatic actinide materials stored at several NNSA sites. The Board reviewed the efforts of the new team to define and execute a strategy to characterize materials for storage or disposition, to identify which materials fall under this effort, and to analyze and upgrade material packaging and storage facility conditions. The Board found that the final report on nuclear materials characterization and storage adequacy failed to meet fully any of the commitments made by DOE in its February 7, 2003 letter to the Board.

Some DOE sites failed to provide or develop a technically defensible means of linking characterization with storage adequacy. The report by the Nuclear Materials Management Team also excluded active nuclear materials from its scope even though DOE's letter to the Board contained a commitment to do so. Ultimately, these unresolved issues led the Board to issue Recommendation 2005-1, *Nuclear Material Packaging* (see Appendix A), as a means of remedying these deficiencies throughout DOE. The Nuclear Materials Management Team did make progress toward disposing of unneeded nuclear materials and identifying technically feasible disposition pathways for materials previously categorized as having no disposition path. However, progress with respect to disposition of many of these materials has been hampered by DOE's inability to approve the pathways.

Surveillance and Monitoring Program for Plutonium Storage. DOE's safety standard entitled *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials* (DOE-STD-3013) establishes requirements for the long-term storage of plutonium metal and oxides, including a surveillance and monitoring program to verify safe storage parameters. Studies by Los Alamos National Laboratory using salt-bearing plutonium oxides have indicated that hydrogen gas generation is highly unlikely to lead to over-pressurization of 3013 containers during storage. Predictions for corrosion of 3013 containers are much less certain. Nonetheless, short-term tests by Los Alamos have shown extensive corrosion pitting of 304L and 316L stainless steel containers holding salt-bearing plutonium oxide with 0.2 to 0.5 weight percent water. In 2005, the Board urged DOE to develop an integrated corrosion study using scientists from Savannah River Site and Los Alamos National Laboratory as co-principal investigators and, if necessary, shift resources from gas generation to corrosion studies. This effort has yielded a new publication, *A Comprehensive, Site-Wide Program for Addressing Potential Corrosion Issues*.

3.1.2 Plutonium

Plutonium Stabilization and Disposition. During 2005, DOE achieved several significant milestones while implementing the Board's Recommendations 94-1 and 2000-1. At Savannah River Site, stabilization and packaging of all applicable pre-existing plutonium metals and oxides and the dissolution of pre-existing plutonium residues have been completed. At the

Rocky Flats Closure Project, shipment of all transuranic waste (including wet combustibles) to the Waste Isolation Pilot Plant was accomplished. DOE is continuing to stabilize and repackage the highest risk items at Los Alamos, a project that will continue through 2011.

Drums Containing Plutonium-238. In 2003, the contractor at the Hanford Site began work to retrieve more than 38,000 transuranic waste containers from burial trenches on site. Within these trenches were 12 drums containing amounts of plutonium-238 that required special handling to ensure safety. In 2005, the Board reviewed DOE's work planning and safety strategy for retrieving these transuranic drums. DOE then retrieved the drums, verified the packaging configuration, and transferred the drums to safe interim storage. DOE is still working to implement the previously developed disposition plan where the preferred alternative is to ship the drums to Savannah River Site for dissolution in H-Canyon and disposition within the high-level waste system.

3.1.3 Uranium

Oak Ridge National Laboratory. Based on direction from Congress regarding the uranium-233 disposition and medical isotopes production program, DOE began writing a report to Congress on how the uranium-233 materials are to be managed. The Board will continue to assess safe storage and disposition of these materials as this program is reviewed and revised.

Savannah River Site. The Board continued to monitor DOE's efforts initiated in response to the Board's Recommendations 94-1 and 2000-1. In 2005, DOE completed the disposition of pre-existing enriched uranium solution and enriched uranium solution resulting from the dissolution of Mk-16/22 spent nuclear fuel.

3.1.4 Neptunium

Oxide Production and Storage. The Board reviewed the adequacy of the process controls used to ensure the purity of neptunium oxide at the HB-Line facility at 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, flammability, and corrosion concerns during storage. The suspect containers were recalcined, and additional process controls and verification sampling have been implemented. The neptunium oxide will be stored at Idaho National Laboratory and used as feed to support the production of plutonium-238 for use in radioisotope power systems.

Developments at Idaho National Laboratory in 2005 included the transition of operating contractor responsibilities from the University of Chicago to Battelle Energy Associates. The Board has worked closely with Battelle and DOE's Office of Nuclear Energy, overseeing the developing plans for the storage and surveillance of neptunium oxide, in anticipation of its use for future space and national security missions. The Board plans additional reviews of the adequacy of the storage configuration and surveillance program in 2006.

3.2 Stabilization of Spent Nuclear Fuel

3.2.1 Hanford Site

The Board continued to provide oversight of spent nuclear fuel and sludge removal activities at the Hanford K-Basins. DOE revised the implementation plan for Recommendations 94-1 and 2000-1 on May 3, 2004. However, by the beginning of 2005, the project had missed a milestone to complete consolidation of sludge in the K-East basin, an activity that has still not been completed.

In a letter dated February 4, 2005, the Board called DOE's attention to continuing design and engineering problems at the Sludge Retrieval Project. DOE responded by directing independent reviews of the design and engineering processes within the sludge project. However, the transfer of sludge from K-East Basin to K-West Basin has been significantly delayed. At the Board's insistence, DOE developed a new implementation plan based on a rigorous and formal risk assessment process, and more realistic assumptions. DOE issued the new implementation plan on November 28, 2005.

With regard to high-activity sludge, DOE approved a strategy in November 2004 for treatment of the sludge that relied on a subcontractor to design, build, and test equipment and to commence operations of the system. The Board reviewed the strategy, finding that requirements related to integrated safety management and facility operations were not adequately applied to the subcontractor. In addition, no design verification of the sludge stabilization system was required, despite its important safety role. Subsequently, DOE revised the subcontract to include the missing requirements and design verifications.

3.2.2 National Spent Nuclear Fuel Program

The Board reviewed the activities of the National Spent Nuclear Fuel Program. In late 2005, DOE held two high-level meetings wherein managers reassessed the status, direction, and schedule of the program. DOE directed Savannah River Site to initiate a comprehensive life cycle analysis of swapping spent nuclear fuel with the Idaho National Laboratory. Aluminum-based fuel would go to Savannah River Site for a combination of processing in H-Canyon and direct disposal, and non-aluminum fuel would go to the Idaho National Laboratory for packaging and shipment to the geologic repository. All of the proposed activities have significant implications for worker and public safety.

3.3 Waste Management

3.3.1 High-Level Waste

Hanford Tank Farms

Tank Integrity. The Board reviewed the effectiveness of the high-level waste tank integrity program for double-shell tanks at Hanford. Following that review, the Board issued a letter to DOE on January 18, 2005, questioning the technical basis for the waste chemistry limits established for corrosion mitigation in the tanks. The Board also requested a report on long-term

management of tank space while maintaining waste chemistry within specified limits. In response, DOE provided a plan for the long-term management of tank space and initiated a laboratory corrosion program to establish the technical basis for the waste chemistry limits. In another letter to DOE dated June 1, 2005, the Board noted that laboratory studies for vapor space corrosion within the tanks were not included in the laboratory corrosion program. DOE agreed to include vapor space corrosion in the laboratory program. In support of these studies, DOE has also scheduled an expert panel review of vapor space corrosion in early 2006 to evaluate the current state of knowledge and determine the appropriate laboratory techniques for this program.

Savannah River Site

High-Level Waste Management. The original implementation plan for the Board's Recommendation 2001-1 included milestones for a salt processing capability and an integrated plan for high-level waste tank space management. While many of these milestones were completed, three milestones remained open due to delays resulting from legal actions, technical difficulties, and changes to the salt processing strategy. Meanwhile, some of the original problems that led to the recommendation continue to affect Savannah River Site. These problems include limited tank space in compliant high-level waste tanks, the lack of salt processing capability, mixed evaporator performance, and the fact that one of the former In-Tank Precipitation tanks (Tank 48) has remained out of service for seven years after the suspension of the precipitation process.

In 2005, the Board urged DOE to revise the implementation plan for Recommendation 2001-1. By way of response, DOE developed new milestones for removal and treatment of salt waste from the tanks. These milestones cover the deliquification, dissolution, and adjustment process, the Actinide Removal Process Facility, the Modular Caustic Side Solvent Extraction Unit, and the Salt Waste Processing Facilities. Additional milestones address returning Tank 48 to service. These processes and facilities, when properly integrated, will be used to remove salt waste and to achieve ultimate closure of the tanks. In order to support these new milestones, the Board conducted technical reviews of Tank 48 flammable gas generation, evaporator performance, and the interim processing plan for high-level waste. The Board determined that additional testing was required to show that the waste in Tank 48 could be disposed of safely at the Saltstone Facility. Due to the risks of this disposal method, the Board encouraged DOE to re-evaluate potential alternatives. Subsequently, DOE's analysis identified two technically credible alternatives.

The Board also reviewed the risks of hydrogen accumulation in the piping and equipment at the Defense Waste Processing Facility and tank farms. DOE has been working to identify potential hydrogen accumulation points in the Defense Waste Processing Facility, calculate the flammable gas generation rates, and model the impacts of a hydrogen explosion on nearby safety equipment. Once this analysis is complete, the Board will review the calculations and the proposed control strategy. In addition, DOE's revised work planning processes for high-level waste tanks to ensure that the potential hazard to facility workers from hydrogen accumulation in failed tank cooling coils has been assessed.

High-Level Waste Operations. At Savannah River Site, DOE initiated an effort to mobilize sludge and remove it from three older-style high-level waste tanks (Tanks 4, 5, and 6)

using new mixer and transfer pumps. The Board observed the readiness review performed by the contractor for the first retrieval (Tank 5) and found its rigor and scope to be inadequate. In response, DOE required the contractor to perform additional reviews to demonstrate the readiness of the facility to begin operations safely. The contractor also established a new position, Manager of Readiness Assurance, to ensure that the readiness process described in DOE Order 425.1C, *Startup and Restart of Nuclear Facilities*, was properly implemented on all subsequent projects at Savannah River Site. By October 2005, DOE had adequately demonstrated facility readiness, and had begun retrieving waste from Tank 5.

Idaho National Laboratory

High-Level Waste Tank Closure. During 2005, the Board reviewed the methods used to clean the laboratory's high-level waste tanks and examined DOE's subsequent chemical analyses showing low levels of residual radioactivity. The Board found the methods acceptable and level of cleanliness adequate to protect the public and the environment. Overall, DOE made good progress in cleaning the high-level waste tanks, and most are ready for closure. Disposition of the waste awaits a Nuclear Regulatory Commission decision that it is waste incidental to reprocessing.

3.3.2 Low-Level Waste and Transuranic Waste

Drum Handling at Savannah River Site. In 2004, the Board reviewed transuranic waste handling activities at Savannah River Site and found deficiencies in the identification of deflagration hazards and corresponding controls for protection of the site workers. The Board noted these concerns in a letter to DOE. In early 2005, DOE managers halted transuranic drum handling until the deflagration hazard was fully understood. DOE then implemented new controls to protect the workers and restarted transuranic drum handling and shipping to the Waste Isolation Pilot Plant. Later in the year, DOE realized that the same type of deflagration hazard in transuranic waste boxes was not properly analyzed in the facility's safety analysis.

Advanced Mixed-Waste Treatment Project. The Board continued its oversight of the Advanced Mixed-Waste Treatment Project at the Idaho National Laboratory through a change of contractors in early 2005. The new contractor improved the organization, staffing, equipment reliability, and training, and resolved outstanding software problems. The Board also directed management attention to two fires that had occurred in the Box Opening Gantry Robot cell, where robots cut the covers off wooden and metal waste boxes. In response, DOE made changes to the vacuum system to eliminate the accumulation of cutting debris that might be ignited by sparks. DOE has successfully shipped more than 4,600 cubic meters of transuranic waste to the Waste Isolation Pilot Plant as of December 2005.

Accelerated Retrieval Project. The Board noted problems with the fire protection system in the original design for the Accelerated Retrieval Project (a tent-enclosed half acre portion of Pit 4) where drums containing radioactive waste are being retrieved at the Idaho National Laboratory. As a result, DOE made design improvements to this system. When the new operating contractor took over in May 2005, all operations were halted to reassess work practices and review radiological control of the work spaces to reduce both external and potential internal exposures. On November 21, 2005, a waste drum exploded during retrieval. DOE assembled an

investigation team to assess the cause of the event and recommend corrective actions. The Board is monitoring DOE's performance to ensure findings are identified and corrective actions enacted.

Tank W-1A. During a review in November 2005, the Board identified deficiencies with work planning for the Tank W-1A soil characterization and sampling project at Oak Ridge National Laboratory. The soil sampling activity has the potential to expose workers to high radiation levels of 6 rem/hr or more. The Board found weaknesses in the application of integrated safety management regarding analysis of hazards and identification and implementation of safety controls. At year's end, DOE acknowledged that additional work is necessary before the soil characterization can proceed safely.

Melton Valley Waste Treatment. The Melton Valley Waste Treatment Project near Oak Ridge National Laboratory is designed to process liquid and solid transuranic waste and low-level radioactive waste for offsite disposal. The Board observed DOE's Operational Readiness Review for the startup of the Treatment Project in mid-November of 2005. The review team discovered that the Melton Valley contractor intended to begin processing 55-gallon drums in a box breakdown area and not take advantage of the main glovebox intended for drum processing. Such an approach would fail to utilize the engineered hazard control afforded by the glovebox and instead rely on personal protective equipment for worker protection. The Board and the review team brought this problem to the attention of DOE, which subsequently directed its contractor to use the main glovebox.

National Transuranic Waste Program. Several DOE sites store large quantities of transuranic waste on concrete pads and in soil-covered trenches. Many sites are retrieving such waste and shipping it to the Waste Isolation Pilot Plant for disposal. During the past two years, the Board observed weaknesses in quality assurance and compliance with program requirements at some sites. The Board has encouraged DOE to improve cooperation and communications between the Waste Isolation Pilot Plant and various transuranic waste generator sites to overcome weaknesses in coordination.

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 2005, the site received and deposited more than 950 shipments of contact-handled transuranic waste with a total volume in excess of 8,000 cubic meters. Throughout 2005, the Board verified that these operations were conducted safely. The Board also began monitoring early preparations for the receipt of remote-handled transuranic waste. Disposal of this more hazardous form of transuranic waste is expected to begin in 2006.

3.4 Facility Deactivation and Decommissioning

3.4.1 Overview

Accelerated deactivation and decommissioning projects are occurring at more and more sites as a result of DOE's accelerated cleanup initiative. Successful decommissioning work has reduced or eliminated hazards at a number of defense nuclear facilities, but the Board has observed difficulties in maintaining a high standard for work planning and safe work execution.

The shift from production operations to decommissioning work involves constantly changing tasks and facility conditions. This problem is further aggravated by a tendency for DOE to view decommissioning work as routine and to relax safety vigilance once bulk quantities of radioactive materials have been removed from a facility. Often, operations personnel in a facility do not have the decommissioning experience necessary to plan and conduct work in a safe and efficient manner. Recognizing this problem, DOE is hiring experienced decommissioning personnel to supplement existing staff.

3.4.2 Fernald Closure Project

During 2005, the Board continued to emphasize worker safety at the Fernald Closure Project. The Board reviewed the safety analysis documentation for the Silo 3 project and suggested changes that DOE's contractor incorporated in the final safety documents. The Board also reviewed readiness preparations to ensure the project was ready to safely begin operations. Remediation activities began in March 2005 and are nearly complete.

The Board performed oversight of the readiness review for startup of the Silos 1 and 2 project. The readiness review was terminated early by project leaders because of several deficiencies. The Board sent a letter to DOE on February 2, 2005, stating that improvements were needed in the management self-assessment process used to verify that the project was ready to begin operations. DOE corrected the deficiencies and improved its management self-assessment process, allowing offsite shipments of waste from Silos 1 and 2 to begin in June 2005.

3.4.3 Miamisburg Closure Project

Activities at Miamisburg Closure Project include cleanout and demolition of buildings formerly used for nuclear materials and explosives research; development, testing, and production activities; removal of contaminated equipment and soil from the site; and environmental restoration. Nine buildings are being transferred to the Miamisburg Mound Community Improvement Corporation, which will operate the site as a technology park after DOE's cleanup activities are completed. Reviews by the Board in 2005 indicated that safety oversight of work activities is adequate. All site closure work is expected to be completed by mid-2006.

3.4.4 Rocky Flats Closure Project

Building 371, the last plutonium processing building at Rocky Flats, was dismantled, and the concrete rubble from the building was shipped offsite. In October 2005, DOE announced that all decontamination and decommissioning operations at the site had been completed. During 2005, the Board strongly encouraged DOE to utilize the lessons learned from the Rocky Flats Closure Project at other DOE cleanup sites. Carrying with them experience and lessons learned, contractor personnel from Rocky Flats have moved on to other DOE sites.

3.4.5 Savannah River Site

Significant lapses in work planning and control during decommissioning work caused several incidents with safety implications in 2004. In response to a December 13, 2004 letter from the Board, DOE strengthened work planning and control. During 2005, the Board continued its oversight of site decommissioning work. Work continued ahead of schedule, but a series of events caused a shutdown for safety reasons in June 2005. The common causes of these events included inattention to detail, failure to stop work when unexpected conditions arose, and less-than-adequate communication during task performance. Continued lapses in work planning and control have caused DOE to reevaluate corrective actions instituted earlier in the year and to evaluate the implementation of these corrective actions.

3.4.6 Hanford Plutonium Finishing Plant

DOE had planned to demolish the Plutonium Finishing Plant at Hanford by 2009. However, recent funding decreases have resulted in postponing demolition of some process equipment, systems, and rooms for a period of 5 to 15 years. Moreover, the plan to send all excess plutonium to Savannah River Site is in doubt. DOE has commenced work on the design of an Interim Secure Storage Facility to be located near the Plutonium Finishing Plant.

Early in 2005, the Board concluded that the corrective actions to fix the previously inaccurate nondestructive assays of plutonium mass were adequate. However, during the year, several violations of criticality requirements occurred. These were caused by the use of improper assumptions in the nondestructive assays and by weaknesses in conduct of operations for movement of fissile materials. The corrective action plans to fix these deficiencies appear adequate to the Board. However, the Board will conduct followup reviews to verify the effectiveness of these corrective actions.

3.4.7 Hanford K-East Basin

The Board reviewed DOE's efforts to plan and conduct deactivation work at K-East Basin, work that will likely be delayed significantly until the radioactive sludge in the basin is removed. After sludge removal, DOE plans to hydrolase the basin walls to remove contamination, grout the basin, and cut it into sections for disposal at the low-level waste facility at Hanford. DOE plans to award two contracts for conceptual design for the cutting and removal of the basin. The Board's review of the work found no safety problems. Reviews will continue as the design is finalized.

3.4.8 Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory is decommissioning 49 gloveboxes and enclosures with a wide range of elemental and isotopic contamination at the Heavy Element Facility. In general, this work requires removal of equipment from the gloveboxes, followed by decontamination of the internal surfaces to low-level waste limits to allow disposal at the Nevada Test Site. Sufficient inventory of radioactive material was removed from the Heavy Element Facility to allow it to be downgraded to a radiological facility. The Board has been observing these activities to ensure safety problems are avoided.

3.4.9 Idaho National Laboratory

During 2005, DOE announced the selection of a new contractor responsible for the Idaho Cleanup Project, which will extend through the year 2012. This contractor is responsible for treatment and disposal of buried waste, safe management of spent nuclear fuel, disposition of nuclear materials, disposition of reactor and non-reactor nuclear facilities, and other environmental remediation activities. The Board visited the site to monitor this work for safety problems. While operational problems have occurred, the Board has not identified significant adverse trends.

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 in excess of $13 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's expectation is that the design and construction phases of defense nuclear facilities will demonstrate clear and deliberate use of integrated safety management principles, core functions, and manuals of practice to be followed throughout design and construction.

During the past year, the Board determined that the design of several new facilities (e.g., the Salt Waste Processing Facility at Savannah River Site and the Demonstration Bulk Vitrification Project at Hanford) did not provide an adequate level of safety for workers. The Board identified these projects to DOE, and corrective actions are being taken. However, DOE continues to have difficulty establishing a conservative design from the beginning of a project. To inquire into the reasons why this is so, the Board convened a public hearing in December 2005 on incorporating safety into design and construction.

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. 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 consider the effects of a calculated increase in

seismic ground motion. Engineering design based on the higher calculated ground motion is continuing.

Structural Design. During 2005, the Board's activities concentrated on the resolution of ground motion issues and on approaches to mitigate the impact of the resulting increase in calculated ground motion. In 2002, the Board challenged DOE's analysis of seismic ground motion. In a report to the Board dated March 16, 2005, DOE acknowledged that the seismic hazards had been substantially underestimated. DOE thereafter slowed construction of the High Level Waste and Pretreatment facilities until more progress could be made on the ground motion question. DOE subsequently developed revised seismic ground motion criteria. The Board believes it would be prudent for DOE to obtain geotechnical data (by drilling deep bore holes) to support the criteria. Such data could be used to support a site-wide seismic hazard analysis for future facilities at the Hanford site.

Fire Protection. For several years, the Board had objected to DOE's decision not to apply fire resistant coatings to structural steel. DOE finally changed course, and a somewhat limited fire proofing project is now in progress. The project is, strictly speaking, consistent with the applicable fire code, but the selective approach taken requires a detailed load analysis to determine which steel members need to be coated. DOE's contractor has prepared structural design criteria for implementing this strategy across the project and is now in the process of completing the calculations.

Hydrogen Gas Hazards. The Board has been reviewing DOE's research into hydrogen generation caused by mixing non-Newtonian liquids. In 2005, DOE's research contractor continued work on a design for a mixing process. While the design is not yet complete, it has proceeded to a degree that the Board has some confidence these liquids can be handled safely. DOE is also examining the build-up and potential burning or explosion of hydrogen in pipes and ancillary vessels. Recently, DOE engaged additional technical expertise to assist in the project, a step viewed positively by the Board. These efforts are planned to continue through early 2006.

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.

Interim Secure Storage Facility. The Interim Secure Storage Facility is a new project at Hanford in the conceptual design phase. Its purpose will be to store Hanford's inventory of plutonium until 2035. While DOE's original plan was to upgrade an existing facility, structural weaknesses in that facility led DOE to consider construction of a new facility.

4.3 Savannah River Site

Plutonium Storage. DOE is planning to consolidate its excess plutonium at Savannah River Site pending final disposition. Some of the material will be used as feed to manufacture mixed-oxide reactor fuel. DOE is in the preliminary stages of design for modifications to the

K-Area facility that would allow immobilizing excess plutonium in glass logs and shipping the logs to the planned Yucca Mountain repository. As requested by Congress, the Board evaluated the facilities planned to be used for this storage. The Board sent its initial report to Congress in 2003 and has issued follow-up reports in 2004 and 2005. The Board's original report concluded that storage of plutonium in K-Area could be safely accomplished but that improvements in fire protection should be undertaken. The Board's study further concluded that DOE should not plan on extended storage of plutonium in Building 235-F without substantial modernization of the safety systems and confirmation of the building's structural adequacy. DOE has recently determined that meeting new security requirements in multiple facilities will not be cost effective and is now planning to store all excess plutonium in the K-Area facility.

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. In a letter to DOE dated August 27, 2004, the Board questioned the adequacy of the facility's confinement of hazardous radioactive materials during a design earthquake. In 2005, an independent review of the design confirmed the Board's view. DOE now plans to upgrade the structure and safety equipment to provide adequate confinement of the radioactive materials.

Pit Disassembly and Conversion Facility. In 2005, the Board continued its design review of the Pit Disassembly and Conversion Facility. The Board found that improvements in the design methodology are needed to ensure that safety margins in the building's capacity to resist ground settlement are properly evaluated. Such settlement could result from an earthquake causing subsidence of geologic soft zones under the facility. Soft zones can cause additional surface settlements that could add more design stresses on the Plutonium Processing Building and on the confinement structure of the facility. The Board believes that DOE has adequate time to manage this problem in the design. The Board also has been closely following other aspects of the design including ventilation, safety analysis, criticality safety, seismic criteria, process safety, and fire protection. The design of safety systems appears to be progressing adequately, but the Board did suggest in its letter dated October 17, 2005, some improvements in the electrical system to account for a possible 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. During 2005, the Board conducted several reviews of component testing and preparations for startup of the facility. In general, the project appears to be progressing acceptably. The facility has an advanced computerized process control and worker protection system. At the Board's suggestion, an independent team of experts assessed the adequacy of this system. Because some maintenance and operations tasks cannot be conducted during the scheduled Operational Readiness Review, the Board suggested that Operational Readiness Review team members observe these tasks during the testing and set up of equipment. DOE accepted this suggestion.

4.4 Y-12 National Security Complex.

Highly Enriched Uranium Materials Facility. The Board completed a review of the design of the Highly Enriched Uranium Materials Facility and concluded that it provides

adequate protection to workers and the public. DOE began construction in early 2005. The Board then evaluated quality assurance and control practices for placement of concrete in the foundation and walls; these practices were found to be deficient. At year's end, DOE had assigned additional personnel to monitor construction activities and initiated other corrective actions in response to the Board's observations.

Uranium Processing Facility. The Uranium Processing Facility is a new project intended to replace a number of aging facilities that process enriched uranium. In 2005, the project's completion schedule was in doubt due to funding reductions. In a letter to DOE dated November 28, 2005, the Board noted that either this new facility or a major upgrade of existing facilities is needed at Y-12 to support long-term performance of national security missions.

4.5 Los Alamos National Laboratory

Research Facility Replacement Project. The Board performed a detailed review of the conceptual design for the Chemistry and Metallurgy Research Facility Replacement Project. To expedite the schedule, DOE is planning to use a design-build approach for the final design and construction of this facility. In a letter dated February 14, 2005, the Board stressed that for this approach to be successful, intense oversight will be required by federal and contractor personnel experienced in the management and oversight of large, complex projects. In response, DOE developed an integrated review plan for the preliminary design phase and committed to further develop this plan as the design moves ahead. The Board also questioned the role of ventilation system design in the overall confinement strategy for the facility. (For details, see DNFSB/TECH-34, *Confinement of Radioactive Materials at Defense Nuclear Facilities.*) DOE has agreed to focus on the design of the ventilation system during the early stages of the preliminary 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 in the conceptual design phase and is currently scheduled to be operational in 2012. In April 2005, the Board performed an onsite review of the safety aspects of the project's activities. The Board was informed that the new bay complex will adopt an overpressure venting strategy for accidental internal explosions different from the strategy used in existing bays. The Board questioned this approach on the grounds that it could increase the risk to workers.

Building 12-64. DOE is considering an upgrade of Building 12-64 so that it can support nuclear explosive operations. The Board reviewed the final design of the upgrade project and determined that DOE had properly established the structural integrity of the roof slabs and an administrative limit on the quantity of high explosives permitted in the bays. Initial bids on this project were unfavorably high; the project is now at a standstill.

Special Nuclear Material Facility. The Board has continued its design review of the Special Nuclear Material Component Requalification Facility. The project is in the startup phase and is expected to be operational in the summer of 2006. The Board conducted reviews of the

ventilation and fire protection systems and of safety basis documentation. The Board noted that although 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

Interim Waste Treatment Unit. The Interim Waste Treatment Unit is a new facility designed to treat approximately 900,000 gallons of sodium-bearing, high-level nuclear waste. A steam reforming process will be used to treat such waste prior to disposal at one of two sites, the Waste Isolation Pilot Plant or Yucca Mountain. Preliminary design has been completed, but the Board has questioned the technical basis for specified safety controls for the processing. DOE's current plan is to dispose of the waste product at the Waste Isolation Pilot Plant, but this disposition path has not been approved. Due to the uncertainty of this disposition path, the Board suggested that testing and evaluation be performed on an alternative waste form that could be disposed at Yucca Mountain. DOE has agreed to include this approach in an expanded simulant testing program.

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 Building TA-18 at Los Alamos to the Nevada Test Site. Design is proceeding on modification of the rooms within the Device Assembly Facility needed for this project. The Board is reviewing the Preliminary Documented Safety Analysis and is evaluating the safety controls for seismic events, criticality, and fire protection. DOE has prepared a safety analysis that would allow some existing fire protection and ventilation systems to be eliminated. The Board does not agree with this approach unless justified by a more detailed technical evaluation that specifically considers accident consequences to workers located near the facility.

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. 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 Recommendation 2004-1

On December 23, 2004, DOE submitted to the Board its proposed implementation plan for this recommendation. The Board rejected the plan in a letter to DOE dated February 14, 2005, and identified areas requiring further attention. On June 10, 2005, DOE delivered a more thorough implementation plan that was accepted by the Board on August 5, 2005. By way of carrying out this plan, DOE has created two Central Technical Authority positions—one for NNSA and one for Energy, Science and Environment, each supported by a small technical staff under a Chief of Nuclear Safety. DOE has established a nuclear safety research function; developed and conducted a training course for safety professionals, senior managers and decision-makers responsible for nuclear safety and oversight; and completed a guidance document on work planning and control processes that also includes criteria and review approaches to comprehensively assess these processes.

DOE also issued a new policy and order 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 manual providing more detailed guidelines and lines of inquiry. These steps are intended to ensure a more uniform process for oversight of the DOE's activities.

5.1.3 Small Business Involvement in Defense Nuclear Activities

Section 6022(c) of Public Law 109-13 mandated that the Administrator of the Small Business Administration, the Chief Counsel for Advocacy of the Small Business Administration, the Chairman of the Defense Nuclear Facilities Safety Board, the Secretary of Energy, and the 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. 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 adequate numbers of trained staff.

5.2 Integrated Safety Management

5.2.1 Overview

Integrated safety management is a concept that evolved from Recommendation 95-2. 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.

5.2.2 Vital Safety Systems

In response to Recommendation 2000-2, DOE has taken steps to ensure the operability of vital safety systems. During 2005, DOE actions in this regard included in-depth reviews of specific systems and programs (such as configuration management) known to have problems. These reviews uncovered weaknesses in the operability of safety systems, leading to further evaluations. As a result of the evaluations, DOE's Office of Environmental Management has formulated corrective actions and has demonstrated an intent to meet individual milestones in Recommendation 2000-2.

On the other hand, the Board has found that several sites have failed in this regard. DOE's own review of Lawrence Livermore National Laboratory in 2005 confirmed significant failures in configuration management, failures the Board had already pointed out to DOE in a letter sent November 3, 2004. During 2005, DOE worked to correct the deficiencies that were previously identified. Actions included the development of a resource-loaded plan to implement configuration management for vital safety systems at Lawrence Livermore.

5.2.3 Activity-Level Work Planning

The Board has continuously emphasized the importance of ensuring that hazards are identified and controlled, that 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 2005, the Board provided

technical oversight for NNSA's effort to write criteria to be used by all NNSA and Environmental Management sites for future reviews of activity-level work planning.

5.3 Health and Safety Directives

5.3.1 Improvement of Directives

During 2005, the Board reviewed approximately 35 new or revised drafts of health and safety directives and policy letters developed by DOE. Highlights of the Board's reviews follow.

Nuclear Facility Safety Order. The Board reviewed and commented on numerous drafts of revised DOE Order 420.1, *Facility Safety*. DOE acted on the Board's comments and published the final version on December 22, 2005.

DOE Oversight Policy and Order. In accordance with the implementation plan for Recommendation 2004-1, DOE developed a new policy and order on oversight. The Board provided extensive comments on both directives that resulted in improvements. DOE is developing a companion safety oversight manual that will provide more detailed expectations for conducting assessments of nuclear operations.

NNSA Policy Letters. On several occasions the Board expressed concern over a new family of directives called policy letters that had no standing in the current directives system. In response, NNSA agreed to suspend using these directives on issues affecting health and safety at defense nuclear facilities until a satisfactory system architecture was developed. In 2005, NNSA decided to eliminate the policy letter system and replace it with a new directives system.

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 but suggested that DOE consider adopting ANSI/ANS-2.26-2004, *Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design*, rather than revising the guide. DOE is considering this course of action.

5.3.2 Worker Safety Rulemaking

On December 8, 2003, DOE published in the *Federal Register* a proposed rule on worker protection, 10 Code of Federal Regulations 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. Thereafter, the Board continued to provide technical oversight of this effort. The Board placed particular emphasis on significantly tightening the proposed exemption criteria, strengthening the tailoring process, and complying with the oversight themes in Recommendation 2004-1. DOE modified the proposed rule considerably based on input from the Board, and published the final rule on February 9, 2006. DOE deferred action on a significant

number of the Board's comments to the rule's implementation guide which will be developed during 2006 with the Board's oversight.

5.3.3 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 DOE M 251.1-1X, *Directives Program Manual*. The Board is currently reviewing the proposed changes.

5.4 Safety Programs

5.4.1 Administrative Controls

Contractors at defense nuclear facilities are required by DOE's principal nuclear safety rule (codified in Chapter 10 of the Code of Federal Regulations, 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 equipment installed 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 2005, completed training for all field offices. DOE is conducting the final field reviews to verify proper implementation of the new standards and expectations. Following the implementation of any corrective actions identified as a result of the field reviews, DOE will revise the safe harbor methodologies associated with the performance of safety analyses to reflect the requirements associated with specific administrative controls.

5.4.2 Active Confinement Systems

The Board issued Recommendation 2004-2 on December 7, 2004; DOE accepted it on March 18, 2005, and submitted an implementation plan on August 22, 2005. The Board found this plan acceptable. According to the implementation plan, DOE is to review the confinement strategy of all new and existing Hazard Category 2 and 3 defense nuclear facilities and ensure that they meet the criteria developed in the implementation plan. Priority will be given to new facilities or major modifications, but all facilities will be reviewed to ensure that they do not rely on building integrity to mitigate the consequences of an event if such a strategy cannot be justified. To date, DOE has prepared a draft guidance document for design and performance expectations of an active confinement system and an evaluation guide that will be used to perform the assessments of ventilation systems.

5.4.3 Quality Assurance

During 2005, the Board continued to demand that DOE 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) assists DOE in making these improvements. The actions taken as part of NNSA's "Quality Assurance Roadmap to Excellence" also have had a positive effect.

5.4.4 Software Quality Assurance

The safe design and operation of many defense nuclear facilities rest upon the analysis and operational support provided by computer codes. Having found safety deficiencies caused by inadequate software design, implementation, testing, configuration management, and training of personnel, the Board issued Recommendation 2002-1 to force significant changes in DOE's policies and practices. During 2005, DOE has worked to complete the implementation plan. DOE completed revisions to personnel documents, and some of its personnel assigned to software quality assurance positions achieved qualification under the Technical Qualification Program. DOE also published several new directives in this area.

5.4.5 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 on November 23, 2005, the Board found deficiencies in the policy as written and objected to the slow pace of its development.

5.4.6 Criticality Safety

When closing Recommendation 97-2 in August 2003, the Board stressed the need for aggressive self-assessment programs and expanded use of operational facility reviews and independent oversight. DOE's performance in this regard has been unsatisfactory, leading the Board to issue a letter on June 22, 2005, criticizing the low number of criticality reviews conducted by DOE. By way of response, DOE briefed the Board on program improvements it plans to make. The Board will continue to evaluate DOE's performance in 2006.

5.4.7 Suspect and Counterfeit Parts

The Board continued to provide oversight and technical assistance to DOE with the objective of preventing the use of faulty parts in critical applications. In 2005, DOE refined the process for finding such parts before they can be used. DOE also conducted extensive field training for managers, craftsmen, and procurement staff. More than 4,000 internal and external

reports of suspect parts were reviewed, resulting in five Safety Bulletins (notifications) and two Safety Alerts (responses required) being distributed to the DOE complex.

5.4.8 Hazard Categories

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, some sites have used nonconservative interpretations that can lead to less vigorous readiness reviews and omission of required reviews of design and safety documentation. The Board requested that DOE take prompt action to eliminate inconsistent implementation of requirements for startups, restarts, safety basis documents, and facility design.

5.5 Technical Competence

5.5.1 Training and Qualification

The Board has a longstanding interest in ensuring the adequacy and rigor of training programs for operators and other health and safety personnel at defense nuclear facilities. In letters to DOE in 2003 and 2004, the Board criticized a number of weak training programs, including the programs at the Nevada Test Site, and the Los Alamos and Lawrence Livermore National Laboratories. In response, DOE has examined the programs and corrective actions being taken. The Los Alamos corrective action plan was delayed by the 2004 laboratory-wide suspension of work, but it was provided in a letter to the Board dated November 4, 2005. Actions are now underway to bring the Los Alamos program into compliance with DOE Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities.*

5.5.2 Facility Representatives

DOE had previously agreed with the Board's observations on shortcomings in the facility representative program. In 2005, DOE hired 13 facility representatives and is attempting to recruit the remaining 7. Meanwhile, DOE is revising the guidance document used for analysis of staffing and training needs (DOE-STD-1063-2000, *Facility Representatives*). A DOE training program has been established for interns, a portion of whom are destined for the facility representative program. The Board has indicated concern that placing interns into this program may dilute the level of competence of the facility representatives.

6. Public Outreach and Agency Administration

6.1 Public Hearings

During 2005, the Board conducted one public hearing in Washington, D.C., regarding DOE's incorporation of safety into design and construction projects. The hearing focused on the need to identify safety requirements early in the design process. Early resolution of how these requirements are to be met in the design, construction, and operations stages of the project results in a safer facility and a reduced chance of costly changes and delays later in the project.

6.2 Responding to Public Requests

The Board answered numerous public requests for documents and information and responded to 33 requests filed under the Freedom of Information Act. The average response time for requests was 5.8 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 all essential, publicly-releasable documents on its website in a timely manner. All documents are available electronically, and all recent documents can be downloaded in Adobe Portable Document Format. The Board upgraded the functionality of its website in 2005 by adding an enhanced search capability, which has greatly improved the ability to find specific documents. The Board also mails paper copies of certain documents (annual reports, technical reports, public hearing notices, and others) to a list of more than 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 2005, the Board directed inquiries into health and safety issues at Hanford, Los Alamos, Lawrence Livermore, and Pantex. The Los Alamos review resulted in improved safety analyses and federal oversight of work at the laboratory. Similarly, the reviews at the other sites 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 Hanford near Richland, Washington; two at Savannah River Site near Aiken, South Carolina; two at the Y-12 National Security Complex in Oak Ridge, Tennessee; one 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 regular briefings from its site representatives in person and maintains continuous contact with them using all available communications media.

6.6 Human Resources

As of December 31, 2005, the Board employed 87 full-time staff including the full-time Board members. 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-six percent of the Board's technical staff holds advanced science and engineering degrees, with 20 percent at the Ph.D. level.

Younger technical staff members have been 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 are four entry-level employees in this program. Three completed their master's degrees in the summer of 2005 and are in their third-year field assignment. The Board's professional development program remains extremely useful in attracting and retaining high-quality, entry-level engineers and preparing them for challenging assignments in their fields. Finally, the Board continues its aggressive 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. Two significant steps taken in 2005 included the appointment of a new Chief Information Officer and the development of an agency-wide Information Systems

Security Program. The Board is also involved in a project to develop policies, procedures, and technical implementation details for Homeland Security Presidential Directive 12.

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 2005, the Board completed a "technology refresh program" and upgraded all of the Board's laptop computers to a standard configuration. Use of a standard configuration significantly improves computer security and streamlines operational support requirements. The Board's internet website (www.dnfsb.gov) 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.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

[Recommendation 2005–1]

Nuclear Material Packaging

AGENCY: Defense Nuclear Facilities Safety Board.

ACTION: Notice, recommendation.

SUMMARY: The Defense Nuclear Facilities Safety Board has made a recommendation to the Secretary of Energy pursuant to 42 U.S.C.2286a(a)(5) regarding the issuance of a requirement that nuclear material packaging meet technically justified criteria for safe storage and handling outside of engineered contamination barriers.

DATES: Comments, data, views or arguments concerning the recommendation are due on or before April 20, 2005.

ADDRESSES: Send comments, data, views, or arguments concerning this recommendation to: Defense Nuclear Facilities Safety Board, 625 Indiana Avenue, NW., Suite 700, Washington, DC 20004–2001.

FOR FURTHER INFORMATION CONTACT: Kenneth M. Pusateri or Andrew L. Thibadeau at the address above or telephone (202) 694–7000.

Dated: March 15, 2005.

John T. Conway,

Chairman.

Recommendation 2005–1 To the Secretary of Energy Pursuant to the 42 U.S.C. 2286a(a)(5), Atomic Energy Act of 1954, As Amended

Dated: March 10, 2005.

Background

In Recommendation 94–1, Improved Schedule for Remediation in the Defense Nuclear Facilities Complex, the Defense Nuclear Facilities Safety Board (Board) urged the Department of Energy (DOE) to improve the packaging and storage conditions of its large inventory of nuclear materials once used for weapons manufacture. In particular, the Board recommended that DOE place plutonium metals and oxides in storage configurations meeting DOE's standard for long-term storage (DOE–STD–3013–2004, Stabilization, Packaging, and Storage of Plutonium-Bearing Materials). Some sites applied Recommendation 94–1 to excess materials only. The Board has continued to evaluate whether other categories of nuclear materials are stored in a safe manner.

DOE has made progress in the stabilization and storage of its excess nuclear materials. The storage requirements for other categories of nuclear materials, however, are not as well defined and controlled. Specifically, DOE Order 5660.1B, Management of Nuclear Materials, does not address safe storage requirements. Other than two narrowly focused standards—DOE–STD–3013–2004 and DOE–STD–3028–2000, Criteria for Packaging and Storing Uranium-233-Bearing Materials—there is no explicit DOE-wide requirement to ensure the safe storage of nuclear materials. Currently, the technical adequacy of packaging—the combination of containers and other components providing a contamination barrier—for nuclear materials, including liquids, is dependent on the safety bases of individual facilities. Typically, facilities have credited engineered features, such as the confinement structure and ventilation system, for protecting offsite individuals and collocated workers. For facility workers, however, the controls are generally administrative, such as continuous air monitors, personal protective equipment, periodic contamination surveys, and other aspects of the radiological control program, in conjunction with proper evacuation training. In accordance with DOE Standard 3009, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis (DOE–STD–3009–94, Change Notice 02), accidents that pose the risk of significant radiological exposure to workers, such as a breached nuclear material storage package, should be prevented or mitigated using safety-significant controls. The preferred hierarchy of controls favors engineered, preventive features over administrative controls.

Establishing packaging requirements for nuclear materials within the DOE complex requires consideration of a diverse population of material types for storage for uncertain periods of time. From a safety standpoint, nuclear material packaging must protect against a number of challenges that could breach the container and release radioactive material. Many of the materials of concern generate gases that result in container pressurization and may be pyrophoric or highly reactive. The container design must take into account corrosion, oxidative expansion of stored metal, effects of radiolysis, diurnal pumping, and damage due to impacts from drops and tooling during handling. The Board's recent review of nuclear material packaging at Lawrence Livermore National Laboratory (LLNL) revealed that many of these insults had not been fully considered when packaging choices were made for nuclear materials not covered by Recommendation 94–1. In fact, many of these current packaging configurations are similar to the inadequate configurations addressed in Recommendation 94–1, and are documented as being susceptible to eventual failure in the report of the Recommendation 94–1 Materials Identification and Surveillance Working Group, entitled Summary of Plutonium Oxide and Metal Storage Package Failures (LA–UR–99–2896).

In general, the hazards posed by nuclear materials covered under DOE's Implementation Plan for Recommendation 94–1 are the same as those for nuclear materials not considered excess. When nonexcess materials are removed from glovebox confinement for interim storage, relocation to another work station, assay, or other purposes, the packages are susceptible to the same types of failures as those addressed in Recommendation 94–1. The longer the materials are stored, the greater are the chances that the packaging will fail, especially if the packaging has not been designed appropriately for the actual duration of storage. The Board found that approximately 15 percent of the nonexcess items at LLNL's Plutonium Facility are stored in packaging more than 5 years old. Some of the older items, previously declared excess, remain in their existing packaging while awaiting stabilization and packaging under DOE–STD–3013–2004. This situation emphasizes the need to establish a technical basis for packaging, such as designating the time period for which a particular container is confirmed to perform its function adequately, in conjunction with tracking the age of containers in use.

Two recent events serve as further reminders of the importance of using packaging that is properly designed for its function:

- An August 5, 2003, event at Los Alamos National Laboratory's (LANL) Plutonium Facility resulted in multiple workers receiving plutonium-238 uptakes as a result of the degradation of a package stored longer than planned. This event is documented in a DOE Type B investigation report (HQ–EH–2004–1). The release of material and the resulting contamination and worker uptakes were due, in large part, to the inadequate packaging of plutonium being stored and handled outside of a glovebox.
- An October 6, 2004, incident at LLNL involved the accidental drop of a package containing salt-bearing

plutonium oxide. This event is documented in an Occurrence Reporting and Processing System report (OAK—LLNL–LLNL–2004–0046). Although no plutonium was released, this event highlights the need to specify robust packaging requirements for materials handled outside of a glovebox.

State of Nuclear Material Packaging

DOE–STD–3013–2004 sets forth requirements for a robust storage configuration for long-term storage of plutonium-bearing materials. The requirements ensure containment through a combination of material form, packaging design, and surveillance of containers. However, the robust, welded configurations in the standard may not be desirable when a short storage period is anticipated pending use of the material.

There are no equivalent requirements for interim storage. As part of its response to Recommendation 94–1, DOE finalized guidance for the storage of plutonium-bearing materials not packaged for long-term storage under DOE–STD–3013. This guidance, identified in a January 25, 1996, memorandum from Deputy Secretary of Energy Curtis entitled Criteria for Interim Safe Storage of Plutonium-Bearing Solid Materials, provides a technically justified approach to safe packaging and storage of plutonium-bearing materials for a period of up to 20 years. Although these Interim Safe Storage Criteria (ISSC) were not intended to apply to materials in working inventory, much of the guidance remains germane to storage of all nuclear materials outside of approved engineered contamination barriers (*e.g.*, gloveboxes or certified shipping containers).

The ISSC were only implemented for selected excess materials and were never formally issued as part of the DOE Directives System. In practice, the sites use a wide variety of packages, many of which do not meet the ISSC. According to the lessons learned from the DOE Type B investigation of the worker uptakes at LANL, packages containing radioactive material should be assumed unsafe until proven otherwise or the materials are repackaged to current standards. Yet sites continue to rely on container types that have been used historically, but have no technically justified safety or design basis. These container types are generally forms of packaging typically used in non-nuclear applications (*e.g.*, paint cans, food pack cans). Thus, they are not designed to protect against the hazards of the nuclear materials they contain for the duration of storage.

Several commonly used containers and their potential inadequacies are briefly summarized in an attachment to this Recommendation. Many other containers are in use for specialized applications.

Remaining Problems

In response to the Board's May 20, 2002, correspondence on safety of nuclear materials storage, the National Nuclear Security Administration (NNSA) established the Inactive Actinide Working Group (IAWG), with the goal of developing a comprehensive approach to the characterization, packaging, and storage of a subset of nuclear materials. As presented in a February 7, 2003, letter from NNSA to the Board, the IAWG was to meet this goal through the development of three strategies for the following: acceptance and retention of nuclear materials, material characterization and storage adequacy, and disposition. The Board has been observing the IAWG's efforts and has made three observations.

First, a key product of the IAWG effort will be the strategy for material characterization and storage adequacy. Based on discussions with IAWG participants, the delivery of this strategy has been delayed, in large part because of disagreements among member sites on the requirements necessary for justifying adequate storage. The Board believes these requirements should provide for sufficient characterization based on an appropriate combination of analysis and process knowledge to determine the appropriate packaging. Characterization information should also be used to develop a surveillance program prioritized according to expected material and container risk (including, for example, material type, material form, and the age and type of container).

Second, in a June 2000 report entitled A Strategic Approach to Integrating the Long-Term Management of Nuclear Materials, DOE recognized the need to update the existing DOE Order on nuclear materials management. In particular, this report urged improvements to the nuclear materials management process. However, neither the current Order nor the report explicitly considers storage safety. The Board believes that DOE should require a technical basis for nuclear material packaging and storage safety. Efforts to meet this requirement should take advantage of the knowledge about storage adequacy being developed by the IAWG, as well as existing guidance, such as the ISSC.

Third, the IAWG strategy does not include other program offices in the defense nuclear complex, such as the Nuclear Energy, Science, and Technology (DOE–NE) facilities involved in defense nuclear activities. Currently, materials and activities in transition between the facilities of different program offices have the potential to be overlooked. For example, operators at the Savannah River Site have begun converting the neptunium-237 solutions covered under Recommendation 94–1 to oxide and placing the oxide in packaging intended for 1 year of storage at that site prior to offsite shipping. The long-term storage of large quantities of neptunium oxide has not been performed previously in the complex, and the technical basis for ensuring the safety of such storage is incomplete. Nonetheless, these materials will be transferred to DOE–NE for use, where they may continue to be stored in their existing packaging for a period of up to 20 years. In addition, the Board has learned that DOE–NE intends to assume more direct control of activities involving plutonium-238, which have to date been performed at NNSA sites. The significant radiological hazards associated with this material necessitate appropriate storage containers for the expected storage period. The Board believes the requirement for a technical basis for nuclear material packaging and storage should encompass all program offices in the defense nuclear complex. DOE may wish to consider implementing this requirement for all program offices, including those outside of the defense nuclear complex.

The Board is encouraged by other efforts currently under way to improve nuclear material packaging. As a result of discussions between the Board's staff and LLNL, the Livermore Site Office, in a December 3, 2004, letter, directed LLNL to develop a technical basis for the adequacy of storage packages as part of a Special Nuclear Materials Storage Plan covering "all packaging activities." LLNL replied in a letter of January 31, 2005, outlining the required activities, milestones, and funding to develop and implement an approved packaging and storage program. Implementation of the plan is contingent upon the availability of key personnel and funding. Likewise, the proposed Documented Safety Analysis (DSA) for the LANL Plutonium Facility requires the use of a proposed facility packaging standard and designates material containers as a safety-related component. However, the new DSA has been awaiting NNSA approval. In general, these efforts represent an improvement, but they do not represent a comprehensive DOE-

wide effort, and significant differences remain in the quality of the efforts at individual facilities.

Recommendation

Nuclear material packaging provides the primary containment boundary to protect facility workers during storage and handling activities. The Board believes the development of technically justified criteria for packaging systems for nuclear materials is necessary on a DOE-wide level. Therefore, the Board recommends that DOE:

1. Issue a requirement that nuclear material packaging meet technically justified criteria for safe storage and handling. Packaging should, in general, provide a robust barrier between facility workers and the stored nuclear materials once they are removed from an approved engineered contamination barrier. It may be appropriate to include this requirement in an updated nuclear materials management Order.

2. Identify which nuclear materials should be included in the scope of the above requirement and then determine the technically justified packaging criteria needed to ensure the safe storage and handling of those materials. The scope need not include waste materials, fully encapsulated forms, or *de minimis* quantities such as analytical laboratory samples. The criteria should account for the nuclear material form and properties, expected future use, and duration of storage. It may be appropriate for this information to be included in a packaging Manual.

The ISSC may provide the beginning of a sound technical foundation for developing such criteria. Although some modifications may be necessary to make the ISSC more applicable to short-term storage, the Board believes the basic ISSC principles—for example, the requirement for a minimum of two contamination boundaries for high-hazard materials such as plutonium, assurance that leak-tightness is maintained for materials requiring a sealed environment, ability of the containers to withstand maximum expected internal pressures, and protection against common insults such as drops—should be maintained. The criteria should also include provisions for surveillance programs to verify that the container and any limited-life components are performing in a manner consistent with the duration of storage.

3. Prioritize implementation of the improved nuclear material packaging requirement consistent with the hazards of the different material types and the risk posed by the existing package configurations and conditions.

John T. Conway,
Chairman.

Attachment

Selection of Commonly Used Nuclear Material Packaging

Food-Pack Cans

Food-pack cans are thin-walled tinned carbon steel containers used in the food industry. No additional manufacturing or structural requirements have been specified for application with nuclear materials. These cans typically rely on a double-crimped metal-to-metal closure with a thin layer of sealing compound to provide leak-tightness. Historically, many sites have reported failures of food-pack cans. Lawrence Livermore National Laboratory (LLNL) has reported anecdotal evidence suggesting that none of its food-pack cans have failed to the point of detectable contamination outside the container (UCRL–ID–11733). However, this same report states further that some degree of oxidation was observed in all of the examined food-pack cans containing plutonium metal, suggesting the lack of an airtight seal. Leakage of oxygen through nonairtight food-pack cans has been responsible for a number of container failures reported at other sites, due to oxidative expansion of plutonium metals (LA–UR–99–2896).

Improvements have been made to the technology, including better sealing equipment, as discussed in a May 1984 report entitled The Effectiveness of Corrective Actions Taken to Preclude Events Involving Tin Cans and Plutonium (RHO–HS–SA–59 P). Some evidence suggests, however, that these containers still may not be adequate for prolonged storage of nuclear materials. Approximately half of the sampled lot of food-pack cans sealed 10 to 14 years earlier at the Hanford Plutonium Finishing Plant using the improved methodology failed leak testing, and nearly all showed further indications of a potential lack of seal (LA–UR–99–3053).

Additional testing performed at Pacific Northwest National Laboratory confirmed that the performance of food-pack cans is highly dependent on the quality of the seal (PNL–5591). During these tests, 33 industry-standard food-pack cans were sealed according to federal specifications. The testing revealed leak rates ranging from less than 10^{-5} cubic centimeters per second (cc/sec) to more than 2 cc/sec. These findings should receive due consideration when food-pack cans are used for storage applications in which a hermetic seal is required. LLNL continues to use food-pack cans as inner and outer containers for the storage of plutonium metal and oxide, and other sites may be storing nuclear materials previously packaged in food-pack cans.

Paint Cans

Paint cans are thin-walled cans with a press-fit lid that are commonly used to store paint. They have been used as both inner and outer containers for the storage of some nuclear materials, including plutonium metal. The press-fit lid is typically placed by hand using a mallet, which results in a questionable seal lacking any evidence of quality control. According to a January 16, 1987, LLNL site report entitled Incident Analysis/Plutonium Burn in Storage Can, oxidation was found to be common for plutonium metal stored in paint cans (memorandum from R.H. Condit to K. Ernst). The report goes on to calculate that a 4 micron gap integrated across the seal area would be sufficient to permit complete oxidation of 100 grams of plutonium metal in 1 year. A leak of this size can reasonably be assumed to be present in the press-fit closure; therefore, the adequacy of these cans for nuclear material storage applications requiring a seal cannot be ensured. Although LLNL reports that ingress of air is expected because the lid and rim of the can are not designed to be airtight (UCRL–ID–117333), paint cans remain approved for use for certain applications at the laboratory. Other sites may also be storing nuclear materials that were previously packaged in paint cans.

Taped Slip-Lid Cans

Slip-lid cans are thin-walled cans with a loose-fitting cover that is often taped. While convenient and inexpensive, the use of these containers has resulted in several breached storage packages, including the plutonium-238 package that led to the Type B event at Los Alamos National Laboratory (LANL). Many nuclear material packages consisting of nested taped slip-lid cans remain at the Department of Energy's defense nuclear facilities. By design, these cans were never intended to serve a containment function. Furthermore, except for tape, a mechanical closure is absent, resulting in a container that may not be able to provide even gross retention of the materials within. The effectiveness of tape in performing this sealing function over time and under high radiation conditions is poorly understood. For this reason, the Interim Safe Storage Criteria (ISSC) specifically prohibit

crediting slip-lid cans as one of the two required contamination barriers. Yet several sites continue to use this type of packaging. For nonmetallic plutonium, including items containing plutonium-238, LANL plans to rely on stainless steel taped slip-lid cans only as an inner container; currently, however, a large number of items remain at the laboratory in nested slip-lid cans. Moreover, several varieties of slip-lid cans continue to be approved for use as inner and outer storage containers for certain materials at LLNL.

Hagan Can

LANL's Comprehensive Nuclear Material Packaging and Stabilization Plan approves the use of a standard container known as the Hagan can, a robust, screw-top container with an O-ring seal and filtered vent. The Hagan can generally meets the expectations of the ISSC and has undergone testing to certify its performance (Wickland and Mataya, PATRAM 98, 1998). However, drop testing was performed at a height lower than the expected maximum storage height; therefore, additional analysis or testing is required. Under the proposed Documented Safety Analysis for LANL's Plutonium Facility, the Hagan can is classified as a safety-significant engineered feature. The Hagan can appears to be an appropriate outer package for nuclear material storage, although, as recognized by LANL, the service life of the Viton (an organic fluorocarbon compound) O-ring requires verification through a surveillance program. Currently, Hagan cans are widely used only at LANL; however, their use may be under consideration at other sites.

Conflat Can

A can fabricated with a Varian-type Conflat flange results in a hermetically sealed, robust container that can be used to store plutonium metal. A copper gasket on a bolted flange closure is designed to maintain a long-term hermetic seal against oxidation of plutonium metal. This closure type has been standard in the high-vacuum industry for many years and has been certified to maintain a leak-tight seal under various temperature and pressure conditions. The Conflat can is identified in LANL's Comprehensive Nuclear Material Packaging and Stabilization Plan as the inner container for the storage of plutonium metal. The use of Conflat cans for storage of other nuclear materials requiring a sealed environment may also be appropriate. Conflat cans have been used periodically at some sites for special storage applications, but their use is not widespread or uniform.

Metal Drums

Several sites commonly use U.S. Department of Transportation (DOT) Type A containers and similar types of metal drums for overpacking of packages of nuclear materials for onsite transportation and storage. These containers have been certified as Type A radioactive material packages per DOT specifications. For transportation purposes, this certification usually is limited to a single year. The use of these containers for interim storage beyond the certification period appears appropriate, but consideration should be given to periodic inspection and replacement for limited-life components, such as lid gaskets. The Criteria for the Safe Storage of Enriched Uranium at the Y–12 Plant (Y/ES–015/R2) allow interim storage of enriched uranium materials for a period of up to 10 years in DOT Type A or Type B containers.

Y–12 Prolonged Storage Container

The Y–12 Y/ES–015/R2 criteria specify the use of stainless steel cans similar to food-pack cans for prolonged low-maintenance storage for up to 50 years. While the reliance on a single robust barrier for the storage of enriched uranium may be appropriate, it is unclear whether the requirement to maintain mechanical and seal integrity during normal handling includes protection against drops. In addition, a lid sealant compound is specified in the appendix to Y/ES–015/R2, but no discussion of its longevity is provided. While fewer radiological hazards and less chemical reactivity are associated with enriched uranium than with plutonium and some other nuclear materials, further testing of these containers would better demonstrate their reliability for long-term storage. Currently, the Y–12 container specification is planned for use only at the Y–12 National Security Complex.

Plastic Bags and Bottles

Historically, plastic bags have been relied upon to provide contamination control for a limited period. Bag materials, which include polyethylene, polyvinyl chloride, and related polymers, play an important role in the overall packaging system. Their principal use is for contamination control during the "bagout" operation, when the nuclear material container is removed from the glovebox. Unfortunately, some types of bags have proven to be detrimental to the integrity of packages left in storage for prolonged periods of time. For example, the radiation-induced degradation of polyvinyl chloride bag material led to the production of hydrochloric acid, which in turn contributed to the corrosion and eventual failure of containers that occurred during the Type B event at LANL. The choice of material also impacts the generation of radiolytic gas and effectively defines the service life of a package when the outer container is not leak-tight. In repackaging campaigns at LLNL, as well as at other sites, such as Hanford, bags commonly have been found to be in a discolored or otherwise degraded state (UCRL–ID–117333 and WHC–SD–TRP–067). While plastic bags have been in use for a long time, little quantitative information exists on the effects of time, temperature, and radiation field exposure on maintenance of an effective contamination barrier. It is recognized that plastic bags may be necessary for contamination control, but they should not be relied upon as a long-term contamination barrier.

In some cases, plastic bottles (*e.g.*, safe bottles) have been used for the storage of solutions containing nuclear materials, especially enriched uranium, outside of processing equipment. While bottles are constructed of thicker plastics than are bags, they undergo the same chemical and radiolytic degradation with time and must be compatible with the chemical properties of the contained liquids. Furthermore, whereas bags provide only contamination control, bottles are relied upon to provide a complete contamination barrier, including structural integrity. Any reliance on plastic bags or plastic bottles for extended periods of time should be informed by the available knowledge of polymer degradation, in combination with information gleaned from surveillance programs.

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DEPARTMENT OF EDUCATION

Indian Education Formula Grants to Local Educational Agencies

AGENCY: Department of Education.

ACTION: Notice reopening the deadline date for the Indian Education Formula Grants to Local Educational Agencies Program.

Catalog of Federal Domestic Assistance (CFDA) Number: 84.060A.

SUMMARY: On January 11, 2005 we published a notice in the **Federal**

Appendix B: 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
98-2	September 30, 1998	Safety Management at the Pantex Plant
99-1	August 11, 1999	Safe Storage of Fissionable Material Called "Pits"
2000-1	January 14, 2000	Prioritization for Stabilizing Nuclear Materials
2000-2	March 8, 2000	Configuration Management, Vital Safety Systems
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 C: 2005 Reporting Requirements

Date	Site or Topic	Response	Due
December 14	Pantex	Report	30 days
November 29	Los Alamos	Briefing	7 days
November 28	Y-12	Report	60 days
November 28	Nevada Test Site	Report	60 days
November 23	Nuclear Risk Assessment	Report	60 days
October 11	Recommendation 2004-1	Briefing	45 days
September 14	Readiness Reviews	Report	90 days
September 9	Pantex	Briefing	annual
September 7	Hanford	Briefing	60 days
July 29	NNSA Policy Letters	Briefing	60 days
June 1	Hanford	Briefing	90 days
May 31	Los Alamos	Report	60 days
May 31	Los Alamos	Report	90 days
May 2	Pantex	Briefing	30 days
April 20	Y-12	Briefing	30 days
March 28	Nevada Test Site	Report	120 days
March 18	Nevada Test Site	Report	45 days
March 8	Lawrence Livermore	Report	< restart
February 24	Los Alamos	Briefing	30 days
February 14	Hanford	Briefing	60 days
February 11	Hanford	Briefing	60 days
February 4	Hanford	Report	60 days
February 2	Fernald	Report	< startup auth.
January 31	10 CFR Part 830	Report	90 days
January 18	Hanford	Report	45 days

Appendix D: Correspondence

Los Alamos National Laboratory

November 29 letter to the Administrator of NNSA imposing a 7-day reporting requirement to explain the necessity for a 3-month strategic pause at the Los Alamos Site Office.

September 1 letter to the Administrator of NNSA granting additional time to prepare an adequate response regarding the confinement ventilation systems at the Plutonium Facility.

July 21 letter to the Administrator of NNSA regarding the resumption of laboratory operations and corrective action plans.

May 31 letter to the Administrator of NNSA imposing a 60-day reporting requirement regarding an effective safety-class system at the Plutonium Facility.

May 31 letter to the Administrator of NNSA imposing a 90-day reporting requirement regarding fire protection.

February 24 letter to the Administrator of NNSA requesting a briefing within 30 days on the design-build approach for the Chemistry and Metallurgy Research Facility Replacement Project.

Lawrence Livermore National Laboratory

March 8 letter to the Administrator of NNSA imposing a reporting requirement regarding the path forward for the resumption of programmatic operations in the Plutonium Facility.

Pantex Plant

December 14 letter to the Secretary of Energy imposing a 30-day reporting requirement regarding the implementation plan for Recommendation 98-2.

September 9 letter to the Secretary of Energy imposing an annual reporting requirement regarding the Pit Management Plan, the Pit Packaging Program, and the closing of Recommendation 99-1.

May 2 letter to the Acting Deputy Administrator for Defense Programs, NNSA, regarding a path forward to improve conduct of operations.

Nevada Test Site

November 28 letter to the Administrator of NNSA with a 60-day reporting requirement regarding safety management programs and vital safety systems at the Device Assembly Facility.

March 28 letter to the Administrator of NNSA imposing a 120-day reporting requirement on the desired conditions of readiness for G-Tunnel.

March 18 letter to the Administrator of NNSA imposing a 45-day reporting requirement regarding leaks and structural cracks at the Device Assembly Facility.

Y-12 National Security Complex

November 28 letter to the Administrator of NNSA regarding the structural deficiencies in the Building 9212 Complex.

July 22 letter to the Acting Deputy Administrator for Defense Programs, NNSA, regarding electrical systems.

April 20 letter to the Deputy Administrator for Defense Programs, NNSA, imposing a 30-day reporting requirement regarding structural deficiencies of Building 9212 Complex.

Savannah River Site

October 17 letter to the Administrator of NNSA regarding the review of the electrical system of the Pit Disassembly and Conversion Facility.

June 10 letter to the Departmental Representative to the Board enclosing a copy of the Board's Second Annual Report to Congress on Plutonium Storage at Savannah River Site.

February 4 letter to the Administrator of NNSA forwarding a report on the Preliminary Documented Safety Analysis for the Pit Disassembly and Conversion Facility.

January 4 letter to the Administrator of NNSA forwarding a report on the structural design of the Pit Disassembly and Conversion Facility.

Hanford Site

October 17 letter to the Secretary of Energy regarding the Board's review of the design and construction of the Waste Treatment Plant.

September 7 letter to the Assistant Secretary for Environmental Management imposing reporting requirements regarding the Demonstration Bulk Vitrification Project.

June 1 letter to the Principal Deputy Assistant Secretary for Environmental Management imposing a 90-day reporting requirement regarding the double-shell tank integrity program.

April 19 letter to the Acting Assistant Secretary for Environmental Management regarding seismic design criteria for the Waste Treatment Plant.

February 14 letter to the Acting Assistant Secretary for Environmental Management imposing a 60-day reporting requirement regarding the Plutonium Finishing Plant.

February 11 letter to the Acting Assistant Secretary for Environmental Management imposing a 60-day reporting requirement concerning criticality safety at the Plutonium Finishing Plant.

February 4 letter to the Acting Assistant Secretary for Environmental Management concerning fire protection for the Waste Treatment Plant.

February 4 letter to the Acting Assistant Secretary for Environmental Management imposing a 60-day reporting requirement on the Sludge Retrieval and Disposition Project.

January 18 letter to the Acting Assistant Secretary for Environmental Management imposing a 45-day reporting requirement on chemistry control for double-shell tanks.

Fernald

February 2 letter to the Manager, Ohio Field Office, imposing a reporting requirement on actions taken prior to startup authorization of Silos 1 and 2 at the Remediation Facility.

Rocky Flats

October 3 letter to the Secretary of Energy regarding the Board's responsibilities under the Memorandum of Understanding.

Other Correspondence

December 16 letter to the Secretary of Energy regarding DOE's new manual on integrated safety management.

November 23 letter to the Secretary of Energy regarding the draft policy on nuclear risk assessment.

November 22 letter to the Secretary of Energy regarding the closing of Recommendation 2002-2.

October 11 letter to the Deputy Secretary of Energy imposing a 45-day reporting requirement regarding the implementation plan for Recommendation 2004-1.

September 19 letter to the Secretary of Energy accepting the implementation plan for Recommendation 2004-2.

September 14 letter to the Deputy Secretary of Energy imposing a 90-day reporting requirement regarding operational readiness reviews.

September 13 letter to the Secretary of Energy accepting the implementation plan for Recommendation 2005-1.

August 5 letter to the Secretary of Energy accepting the implementation plan for Recommendation 2004-1 and forwarding suggested additions to the project execution plan.

July 29 letter to the Administrator of NNSA imposing a 60-day reporting requirement regarding the Policy Letter System.

July 25 letter to the Deputy Administrator for Naval Reactors, NNSA, regarding the Naval Reactors safety program.

July 21 letter to the Secretary of Energy granting an extension of 45 days in which to submit an implementation plan for Recommendation 2004-2.

June 22 letter to the Deputy Secretary of Energy regarding DOE's Second Annual Nuclear Criticality Safety Program report.

June 21 letter to the Secretary of Energy commending Jeff Cravens and Robert Knighten of the Y-12 Site Office and Idaho Operations Office as the 2004 Facility Representatives of the Year.

March 10 letter to the Secretary of Energy forwarding Recommendation 2005-1.

February 18 letter to the Deputy Administrator for Naval Reactors, NNSA, expressing appreciation for a seminar given to the Board and its staff.

February 14 letter to the Secretary of Energy providing feedback on the DOE's 2004-1 implementation plan.

February 10 letter to the Secretary of Energy granting an extension of 45 days to respond to Recommendation 2004-2.

January 31 letter to the Deputy Secretary of Energy imposing a 90-day reporting requirement regarding 10 CFR 830 documented safety analyses.