DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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February 24, 2004

Mr. Mark B. Whitaker Jr.
Departmental Representative to the DNFSB, DR-1
U. S. Department of Energy
1000 Independence Avenue, SW
Forrestal Building, Room 6H-025
Washington, DC 20585-1000

Dear Mr. Whitaker: Mark

The Defense Nuclear Facilities Safety Board (Board) is pleased to enclose a printed copy of its Fourteenth Annual Report to Congress which describes the Board's health and safety activities relating to the Department of Energy's defense nuclear facilities during the calendar year 2003.

Sincerely,

John

John T. Conway
Chairman

Enclosure: As stated

FOURTEENTH ANNUAL REPORT

TO CONGRESS

DEFENSE NUCLEAR FACILITIES
SAFETY BOARD

FEBRUARY 2004

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To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to Congress its Fourteenth 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 Department of Energy (DOE) defense nuclear facilities.

As required by statute, the Board's report summarizes activities during calendar year 2003, assesses improvements in the safety of DOE defense nuclear facilities, and identifies remaining health and safety problems.

Respectfully submitted,

John T. Conway
Chairman

A. J. Eggenberger
Vice-Chairman

John E. Mansfield
Member

R. Bruce Matthews
Member

PREFACE

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

The Board is required to review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements, practices, and events relating to system design, construction, operation, and decommissioning of DOE's defense nuclear facilities. The Board makes recommendations to the Secretary of Energy that the Board believes are necessary to ensure adequate protection of public health and safety. The Board 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 must publish his or her decision and reasoning in the *Federal Register* and must formally notify 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.

The Board may conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, and take other actions such as establishing reporting requirements for DOE in furtherance of its oversight of health and safety at defense nuclear facilities. The Board has noted that the use of requests to the Secretary of Energy for detailed reports on safety issues raised by the Board has regularly resulted in prompt actions by DOE to remedy the situation.

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 defense nuclear facilities during the period covered by the report; (2) the improvements in the safety of DOE 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 defense nuclear facilities.

EXECUTIVE SUMMARY

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 the environment.

During this past year, actions by the Board resulted in numerous health and safety improvements that are summarized briefly below and in more depth in the main body of the report. These improvements are described along the lines of 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 2003, 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 weapon 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.

Pantex Plant:

- Pits of fissionable material have been repackaged into sturdy containers suitable for interim storage (Recommendation 99-1).

- The SS-21 process[1] for W62 Disassembly and Inspection and for W88 Bay operations was completed; development of SS-21 processes for other weapons programs (W78, B83, W87, B61) commenced.

- The Nuclear Explosive Safety Studies (NESS) Process Guide was revised to ensure better coordination between NESS and readiness reviews.

- Significant deficiencies in the quality assurance of software used to control on-site transportation of nuclear materials and nuclear weapons were corrected.

Y-12 National Security Site:

- The quantities of combustible organic liquids stored in Building 9212 have been restricted and further fire protection improvements will be undertaken.

- A conduct of operations improvement plan was developed to correct numerous deficiencies in conduct and formality of nuclear operations.

- Criticality safety was substantially upgraded by reduction of the amount of fissile materials stored at the site and by simplifying requirements for material storage and containers.

- The venting of drums storing depleted uranium chips was undertaken to place the chips in a safe condition for long-term storage; other actions were taken to verify that similar storage deficiencies did not exist elsewhere on the site.

All weapons laboratories:

- The Secretary of Energy (a) affirmed in writing that the highest priority work at these laboratories has been, and remains, support for the nation's nuclear weapon stockpile, and (b) directed each nuclear weapons laboratory to establish single points of contact for safety issues affecting each weapon to ensure that proper actions are taken. (Recommendation 2002-2)

Los Alamos National Laboratory:

- Deficiencies in the safety basis and safety controls associated with the new aqueous processing line for recovery of scrap Plutonium-238 (Pu-238) were corrected.

[1] SS-21 is the preferred protocol for weapons assembly and disassembly at Pantex. It is designed to achieve controlled interactions of the weapon, personnel, facility, tooling, and equipment at all stages of the operation.

Los Alamos National Laboratory (cont.):

- Funding for upgrades to the site-wide fire alarm system was restored, reversing a decision by DOE to eliminate funding from the FY03 budget.

- Deficient work planning requirements are under revision.

Lawrence Livermore National Laboratory:

- Inadequacies in the safety bases for the Plutonium Facility, the Hardened Engineering Test Facility, and the Material Management Source Vault will be corrected.

Nevada Test Site:

- The capability to safely resume underground nuclear weapons testing has been markedly improved.

Savannah River Site:

- Errors and omissions in software specifications for safety systems were corrected.

NUCLEAR MATERIALS PROCESSING AND STABILIZATION

The Board's strategic performance goal for this area is to ensure that DOE's program for handling of hazardous nuclear materials and deactivation and decommissioning of unused facilities 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 the stabilization and storage of nuclear materials, storage and disposition of defense nuclear waste, and deactivation and decommissioning facilities.

As a result of the Board's efforts during 2003, DOE has taken actions to reduce or eliminate risk and improve safety. These actions include stabilizing and improving the storage conditions of nuclear materials, correcting deficiencies in the formal conduct of operations, improving the quality of engineered safety systems, and correcting deficiencies in the safety bases for new and ongoing activities.

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

Hanford Site:

- Safety improvements were made in the Spent Nuclear Fuel Project (SNFP), including completion of closure welds on suspect spent fuel containers, refinement of the controls for hydrogen generated in K-Basin sludges, and tightened safety controls on fuel transfers between basins.

Hanford Site (cont.)

- Safety controls for retrieving transuranic wastes in earth-covered trenches were strengthened.

- The safety analysis, content of safety requirements, and rigor in verifying implementation at the tank farm have all been enhanced.

- Chemistry and corrosion control problems in double-shell tanks controlled by adding corrosion-inhibiting chemicals.

Rocky Flats Environmental Technology Site:

- Deficiencies in work planning and oversight are being corrected following a glovebox fire. (Board investigation)

Savannah River Site:

- Deficiencies in ventilation and fire protection systems in the K-Area Material Storage (KAMS) facility will be corrected.

Fernald Closure Site:

- Corrective actions to improve worker safety were implemented to better train and protect inexperienced workers.

NUCLEAR FACILITIES DESIGN AND INFRASTRUCTURE

The Board's strategic performance goal for this area is to ensure that new DOE 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 recent years, there has been an increase in the number of new DOE projects, with 20 to 30 projects currently in the design and construction phase. As a result of the Board's efforts during 2003, DOE has taken action to enhance safety in the design and construction of new defense nuclear facilities.

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

Hanford Site:

- Potential safety flaws in the design of the Waste Treatment Plant were identified and investigated.

Y-12 National Security Site:

- Changes were made to improve the foundation design for the Highly Enriched Uranium Material Facility.

Complex-wide:

- Reliability of High Efficiency Particulate Air (HEPA) filters used in safety applications was enhanced.

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 sites and facilities.

As a result of the Board's efforts during 2003, DOE has taken actions to strengthen the technical competence of its contractors, establish and implement safety standards, improve the quality of engineered systems, and increase the effectiveness of oversight and generic safety programs such as Integrated Safety Management.

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

- Administrative safety controls were strengthened. (Recommendation 2002-3)

- The quality of software used in safety applications was enhanced. (Recommendation 2002-1)

- The operability of vital safety systems has been confirmed; important technical positions are being filled and personnel given additional training to serve as system engineers. (Recommendation 2000-2)

- Stronger measures were taken to prevent DOE's purchase and use of suspect and counterfeit parts.

- Corrective actions were taken to correct deficiencies in training at NNSA sites.

OUTSTANDING SAFETY PROBLEMS OF DEFENSE NUCLEAR FACILITIES

I. The quality of federal oversight in the defense nuclear complex.

DOE is engaged in making major changes in its approach to safety oversight of defense nuclear facilities. DOE is currently implementing, or is planning, three simultaneous initiatives that affect its safety oversight of defense nuclear facilities. The sum and substance of this initiative is to place principal reliance on the contractor to ensure that work is done safely, move from prescriptive requirements to performance criteria, and decrease reliance on centralized federal safety oversight of contractor operations. In the midst of this, information developed by the Columbia Accident Investigation Board with respect to the loss of the space shuttle, and by the U. S. 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. In furtherance of its statutory duty to protect the public health and safety from hazards at defense nuclear facilities and its charge to restore confidence in DOE's management capabilities, the Board conducted six public meetings between September and December 2003. The meetings, which will continue in 2004, are intended to provide a record on which to assess DOE's proposals for changing its oversight, contract management, and directives systems.

During its public meetings, the Board received testimony from representatives of the U.S. Nuclear Regulatory Commission, the Naval Reactors Program, the Columbia Accident Investigation Board, the Deputy Secretary of Energy, the Administrator of NNSA, the Undersecretary for Energy, Science and Environment, selected DOE and NNSA Site Managers, and senior contractor managers. In addition to the public meetings, the Board invited social science experts to present in-house seminars to enhance understanding of the causal relationships between organizational behavior and technical operations of complex, high hazard activities. In 2004, the Board will assess DOE's oversight changes in light of the information that has been gathered.

II. Laboratory Support for Weapons Activities.

The Board issued Recommendation 2002-2 to ensure that safety information developed at the national defense laboratories is adequately communicated to DOE's defense nuclear complex, and to preserve the priority of nuclear weapons projects in the face of competition from other activities. In 2003, DOE continued its implementation of this Recommendation. An essential task is the establishment at each defense laboratory of a single point of contact for each nuclear weapon system. These individuals ensure that safety questions are promptly and effectively answered and that safety issues are tracked to adequate closure.

DOE has explicitly directed each NNSA defense laboratory to assume the responsibility for ensuring that requests for laboratory support to resolve safety issues are tracked and fulfilled. Conflicting demands on laboratory resources are not to be allowed to hold up action on requests for weapon safety assistance. The Board has observed some progress in this area, but it is apparent that very close scrutiny of the implementation of this Recommendation will be required for some time.

III. Safe retrieval, handling, and stabilization of nuclear materials and high-level waste.

The Board has issued several Recommendations to DOE to expedite the stabilization of materials in deteriorating storage conditions. Of greatest concern are the spent nuclear fuel and associated sludges in the K-Basins at Hanford, high-level waste in underground tanks that have aged beyond their intended design lives at Hanford and Savannah River Site (SRS), and large quantities of nuclear materials at Los Alamos National Laboratory (LANL) for which DOE has not presented a complete and acceptable stabilization plan.

DOE still must clear many technological and programmatic hurdles. At the Spent Nuclear Fuel Project (SNFP) at Hanford, the Board has identified programmatic breakdowns in engineering, nuclear safety, project management, and oversight. These failings have substantially delayed the previously planned December 2002 start-up of sludge retrieval and may result in DOE abandoning the current sludge retrieval process. In addition, these problems have impeded the removal of fuel from the basins. The Board intends to maintain a high priority for the oversight of this effort.

DOE's plan to retrieve and treat high-level waste from underground storage tanks at SRS, Hanford and the Idaho National Engineering and Environmental Laboratory (INEEL) is subject to considerable uncertainty. The Board has focused its attention on technical and safety challenges arising from DOE's attempts to implement first-of-a-kind technologies for retrieval, treatment, and disposal of High-Level Waste (HLW).

Finally, significant quantities of nuclear materials remain unstabilized at LANL. DOE has not made sufficient progress in treating these materials and have yet to submit an acceptable implementation plan to meet the requirements of Recommendations 94-1 and 2000-1. DOE's latest plan shows this important task remaining incomplete until 2010—far too long in the Board's view.

IV. The adequacy of safety systems in aging facilities.

The Board issued Recommendation 2000-2[2] to ensure that aging safety systems are properly maintained. DOE found, in response to this Recommendation, deficiencies in safety systems that are being addressed, but much more remains to be done in 2004 and beyond. Many of the safety analysis revisions resulting from implementation of the nuclear safety management rule (10 CFR Part 830) assigned safety related functions to systems that had not previously served this purpose. The Board will continue its efforts during 2004 to ensure that these systems satisfy safety class or safety significant criteria.

V. The adequacy and quality of safety controls.

Previous efforts by the Board led to several DOE initiatives to improve upon, and ensure the adequacy and quality of, safety controls relied on in defense nuclear facilities. Actions taken

[2] *Configuration Management, Vital Safety Systems*, issued March 8, 2000.

to carry out the Implementation Plan for the Board's Recommendation 2002-1[3] should lead to correction of flaws in software affecting safety. By the same token, DOE's Implementation Plan for the Board's Recommendation 2002-3[4] should lead to actions strengthening administrative controls affecting safety. DOE's Quality Assurance Improvement Plan is intended to correct deficiencies identified by the Board in the quality of engineered safety systems, covering such matters as design, fabrication, procurement, and installation. In addition, actions by the Board led DOE to strengthen its program to prevent the introduction of suspect and counterfeit items into safety systems. All of these initiatives will remain a focus of the Board's attention during 2004.

VI. Ensuring that safety is addressed early in the design and construction of new facilities.

With more than 20 DOE projects currently in the design and construction phase, the Board will need to maintain a significant focus on the review of design and construction activities during 2004. Reviews of the design and construction of major facilities and projects are resource intensive and time consuming, but they result in significant safety improvements. The Board's reviews of the Waste Treatment Plant (WTP) at Hanford, the Tritium Extraction Project and Plutonium Disposition and Conversion Facility at SRS, and the Highly Enriched Uranium Material Facility at the Y-12 National Security Site, have ensured the adequacy of the design, drawings, and specifications. The reviews have also ensured that the physical design is consistent with system functions and requirements and that all safety structures, systems, and components are adequately incorporated into the design. The Board has demonstrated the value of rigorous technical oversight to ensure that safety is addressed early in the design process and intends to continue to focus on these activities in 2004.

VII. The technical competence of DOE and contractor personnel.

The Board has devoted constant effort for more than a decade to ensure that DOE maintains and continually upgrades the knowledge, skills, and abilities of its technical personnel. During the past three years, DOE has been updating technical qualification standards for its federal employees and placing them in the DOE Directives System, where they can be formally controlled. In 2003, the Board reviewed and provided extensive comments on 16 new or revised Functional Area Qualification Standards. DOE should complete this effort during 2004.

In Recommendation 2000-2, the Board urged DOE to institutionalize the use of system engineers and federal subject matter experts for vital safety systems. DOE is now attempting to fill these important technical positions, but in the Board's view more senior management attention and resources are needed during 2004 for this effort. The functional area qualification standards for these positions are expected to be completed during 2004.

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[3] *Quality Assurance for Safety Related Software*, issued September 23, 2002.

[4] *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*, issued December 11, 2002.

VIII. Development, maintenance, and implementation of safety-related standards.

During 2003, the Board reviewed 68 new or revised drafts of DOE health and safety directives and NNSA policy letters. The Board's review of NNSA's internal policy directives system revealed significant weaknesses and inconsistencies. The Board will provide oversight of NNSA's efforts in 2004 to design a system consistent with safety priorities. The Board will also continue to work towards strengthening DOE's directives and standards affecting safety at defense nuclear facilities.

In an additional development, on December 8, 2003, DOE provided notification of a proposed rule on worker protection, 10 CFR Part 851, *Worker Safety and Health*. This action was required under the Bob Stump National Defense Authorization Act, Public Law 107-314, which directed DOE to promulgate regulations on worker safety and health, rather than rely exclusively on a contractual approach. The Board is conducting a detailed review of the proposed rule. Of immediate concern is that DOE intends to cancel DOE Order 440.1A, *Worker Protection Management for D0E Federal and Contractor Employees*. Currently, this order and its associated manuals and guidance documents provide specific safety requirements for several areas of interest to the Board: explosives safety, pressure vessel safety, and suspect and counterfeit parts. They also serve as implementing directives for Integrated Safety Management at the activity level. Many requirements and guidance, painstakingly developed during 50 years of experience across the complex, may be lost unless these requirements and guidance are formally implemented in a new set of directives to be issued concurrently with the new rule. During 2004, the Board will be heavily involved in DOE's efforts to satisfy Public Law 107-314 in a manner that provides optimal protection of worker health and safety.

IX. The continued implementation of complex-wide safety programs such as Integrated Safety Management and criticality safety.

In 2003 the Board devoted particular attention to three integrated safety management (ISM) initiatives: improvement of the annual update process, completion of DOE's implementation of Recommendation 2000-2, and full use of ISM at the activity level. The concept of ISM is particularly well suited to ensuring safety at the activity level, and the Board will continue this focus in 2004.

The Board is closely monitoring DOE's criticality safety program. During 2003 the Board closed Recommendation 97-2,[5] with the expectation that improvements accomplished because of it will be maintained and assessed on a yearly basis. During 2004 the Board will ensure that DOE embeds criticality safety practices into its organizational structure and manuals of practice.

The current plan to relocate the LANL Critical Experiment Facility to the Nevada Test Site is of great interest to the Board because this facility represents a key component in DOE's capability to develop, train, and maintain a core of exceptionally qualified engineers specializing

[5] *Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy*, issued May 19, 1997.

in nuclear criticality safety. During 2004 the Board will closely follow implementation of this relocation plan to ensure there is no detrimental interruption of operations or loss of capability.

X. Formality and discipline of nuclear explosive and nuclear processing operations.

The safety of operations involving nuclear explosives and other nuclear materials is assured through verbatim compliance with explicit procedures by trained personnel. In 2003, the Board identified numerous deficiencies in the formality of explosives operations. DOE is developing corrective action plans to correct these deficiencies. The Board will assess the effectiveness of DOE's corrective actions in 2004.

OUTSTANDING SAFETY PROBLEMS IN 2002 REPORT

In the Thirteenth Annual Report for CY2002, the Board identified three outstanding safety problems. One of these was identical to item II above. Progress in 2003 on the other problems discussed in last year's report has been as follows:

Ensuring Safety in the Design and Construction of New Defense Nuclear Facilities.

- **New Facilities.** The Board reviewed design and construction activities at the Hanford Waste Treatment Plant, the Highly Enriched Uranium Materials Facility at the Y-12 National Security Site (Y-12), the Pit Disassembly and Conversion Facility and the Tritium Extraction Facility at the SRS, the Melton Valley Waste Treatment Facility at Oak Ridge, and the Dynamic Experiments Project at LANL.

- **Major Modifications.** The Board provided oversight of modifications to Building 12-64 at Pantex, Technical Area 18 (TA-18) at LANL, and the K-Basins Spent Nuclear Fuel Project at Hanford.

Ensure Effective and Reliable Controls to Protect Health and Safety.

- **Recommendation 2002-3*, Requirements for the Design, Implementation, and Maintenance of Administrative Controls*:** DOE provided an Implementation Plan for this Recommendation and began its execution.

- **Suspect and Counterfeit Parts:** Under continuous Board scrutiny, DOE revamped its program for preventing the use of such parts at defense nuclear facilities.

- **Quality Assurance:** DOE (1) began to correct deficiencies identified by the Board in the quality of engineered safety systems, and (2) developed and began implementation of an Implementation Plan in response to the Board's Recommendation 2002-1.

HUMAN CAPITAL MANAGEMENT

The ability of the Board to fulfill its mission depends heavily on attracting and retaining top-caliber, competent technical staff. The Board has been successful in creating a work environment that emphasizes excellence as the standard for staff performance, and rewards staff members accordingly. The pay banding and pay-for-performance programs developed and implemented by the Board have proven to be effective in hiring technical talent, holding employees accountable for their performance, and rewarding outstanding performance on the job. This is evidenced by the low turnover rate, which was about four percent in 2003 even when intern hiring is taken into account.

In 2003, the Board operated at 63 percent of its statutory employment ceiling of 150 Full Time Equivalents due to fiscal constraints. Within these constraints, however, the Board used its statutory excepted service hiring authority, along with recruitment and relocation bonuses, student loan repayments, and retention allowances to hire and retain competent personnel. This approach has allowed the Board to remain successful in securing scientific and technical staff in a competitive employment market.

During the year 2003, the Board continued to require its engineers and scientists to maintain the highest level of technical knowledge to meet a wide range of health and safety challenges. Ninety percent of the senior technical and legal staff hold advanced degrees, 33 percent of which are at the Ph.D. level. To meet future staffing needs, the Board continued its recruitment of senior, experienced technical staff. To attract recent graduates, the Board relies on its Professional Development Program, a 3-year program that brings entry-level technical talent into professional positions within the Board. The Board provides them a technical mentor, individually-tailored developmental assignments, post-graduate education, and a one-year, hands-on field assignment. This is a highly competitive program to attract the next generation of scientific and technical talent to federal service.

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1. INTRODUCTION

1.1 BACKGROUND

The Defense Nuclear Facilities Safety Board (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 civilian nuclear weapons facilities managed by the Department of Energy (DOE). 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 facilities for many purposes. All of these functions must be carried out in a manner that protects the public, workers, and the environment.

Congress established the Board to serve as an independent, expert agency capable of understanding the complexity of 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: nuclear, mechanical, electrical, chemical, fire protection, and structural engineering, as well as physics and metallurgy. Currently, 90 percent of the Board's technical staff hold advanced degrees, of which 33 percent are at the Ph.D. level.

The Board has established site offices at five high-priority defense nuclear sites: the Pantex Plant in Texas, Los Alamos National Laboratory (LANL) in New Mexico, the Y-12 National Security Complex (Y-12) in Tennessee, Savannah River Site (SRS) in South Carolina, and the Hanford Reservation in Washington State. The site offices provide the Board with a continuous presence at these locations.

During the Board's 14 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. The Strategic Plan was revised during 2003; it now contains four Strategic Areas of Concentration, an increase from prior years' three. This report is organized using the revised strategic plan as its outline.

This Annual Report summarizes the Board's work during calendar year 2003. 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 addresses the Board's interactions with the public. Appendices A through E provide additional material: a table of all Recommendations cited in this report (Appendix A), a list of reports requested from DOE (Appendix B), a list of the Board's letters (Appendix C), a summary of administrative and human resource activities (Appendix D), and a list of acronyms and abbreviations used in this report (Appendix E).

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 (a) risks to the public and the workers, (b) the types and quantities of nuclear and hazardous material at risk, and ©) the hazard 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 45 formal Recommendations, comprising 210 individual sub-recommendations. In that same period of time, the Board has issued 115 reporting requirement letters. In 2003 alone, the Board issued 26 such letters to DOE, the majority aimed at operational safety and integrated safety management.

The Board's Recommendation authority has been used most fruitfully to gain DOE response to complex-wide hazards and safety management problems. Examples of such matters

include stabilization and remediation of hazardous materials, technical qualifications of DOE and contractor personnel, criticality safety, and configuration management of vital safety systems. In view of the typical breadth and complexity of the issues addressed by a Recommendation, several years are often needed for DOE to develop an implementation plan and carry it to completion. By contrast, the reporting requirement has been an effective tool in obtaining more expeditious action. By using each method in appropriate cases, the Board has been able to enhance safety and minimize delays and administrative costs to the government.

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 associated with the handling of nuclear weapons, weapon materials, and cleanup 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 only 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 nuclear weapon operations, which involve the handling of high explosives in proximity with 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, stabilization, and disposition 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.

The remainder of this report is organized according to these safety goals.

2. NUCLEAR WEAPONS OPERATIONS

2.1 SAFE CONDUCT OF STOCKPILE MANAGEMENT

Stockpile management is the term used to describe 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

Pantex, located near Amarillo, Texas, serves a central role in stockpile management. Operations at the site include the assembly, disassembly, dismantlement, and surveillance of nuclear weapons, as well as interim storage of plutonium removed from retired weapons. In 2003, the Board sought health and safety improvements in weapons operations, fire protection, lightning protection, laboratory support, and storage of special nuclear materials. The Board's pursuit of operational safety improvements at Pantex involved three related areas: development of adequate safety bases, re-engineering of nuclear explosive processes consistent with Recommendation 98-2, and operators' procedural compliance.

SS-21 Upgrades. For several years, the Board has been exhorting DOE to improve the safety of weapons-related work at Pantex, as provided in Recommendation 98-2. A key concept of this Recommendation was that DOE needed to simplify and expedite the re-engineering of nuclear explosive processes at Pantex, such that attendant safety improvements could be put in place more rapidly. In this regard some progress was made in 2003. DOE completed the start-up of the SS-21 process for W62 Disassembly and Inspection Program and for the W88 Bay operations. DOE has also begun development of SS-21 processes for the W78, B83, W87, and B61 weapon programs. The prompt completion of re-engineering the nuclear explosive processes for the remaining weapon programs will result in substantial safety improvements.

Transportation and Fire Protection. The Implementation Plan for Recommendation 98-2 includes a commitment by DOE to improve on-site transportation and fire protection at Pantex. In response to the Board's critical examination of these areas, DOE completed safety basis documents and implemented essential safety controls.

Nuclear Materials Management. The Board reviewed the management of inactive actinide and legacy nuclear materials at Pantex, including Radioisotopic Thermoelectric Generators containing Plutonium (Pu)-238 (in interim storage). Site personnel initially identified three groups of items as constituting inactive actinide materials, but the Board identified other materials that need a clearly defined disposition path and final endstate to be achieved through the inactive actinide program. In a July 2001 letter, the Board raised several other materials management issues regarding the packaging and storage program at Pantex. By the end of 2003, DOE had made progress in completing corrective actions.

Software Quality Assurance. In a letter dated March 25, 2003, the Board highlighted significant quality assurance faults in the Move Right System, software used to control the on-site transportation of nuclear materials. In response, Pantex upgraded requirements for software

quality assurance and took compensatory actions to improve the transportation program until the software system is strengthened.

Repackaging of Pits. In response to Recommendation 99-1, DOE has continued to repackage pits into durable containers suitable for interim storage. DOE has now repackaged more than 8,600 pits. The associated container surveillance program has also been rejuvenated; the surveillance backlog was worked off by the end of fiscal year (FY)03.

Hoisting and Rigging Safety. The proper planning and conduct of lifting activities is essential to safe operations at Pantex. In a letter dated July 10, 2003, the Board provided an assessment of the hoisting and rigging program at Pantex. The Board identified a number of weaknesses in equipment design, reliability, maintenance, and training. In response, DOE implemented a number of improvements.

Training. In an April 4, 2003, letter, the Board highlighted problems at Pantex with the methods used to develop training courses, evaluate personnel knowledge, assess training program elements, and ensure continuous training. These serious deficiencies affect the ability to maintain and improve the conduct of operations at Pantex. In response, DOE developed short-term and long-term action plans to correct the deficiencies. Further DOE actions, in response to the Board's letter, included an assessment of the Pantex training program that confirmed the Board's findings and led to additional corrective actions.

A specific training issue was identified by the DOE readiness assessment for W62 disassembly and inspection operations. First line supervisors at Pantex were not trained on program-specific procedures, and were not responsible for ensuring that production technicians implemented procedures in accordance with program-specific training. This issue was not limited to W62 operations and, in fact, involved all nuclear explosive operations. Encouraged by the Board to take immediate action, site management promptly initiated a self-study training program to ensure that first line supervisors are familiar with the safety basis for the programs they supervise.

NESS and Readiness Review Conflicts. The Board has repeatedly warned the National Nuclear Security Administration (NNSA) that concurrent Nuclear Explosive Safety Studies (NESS) and readiness reviews at Pantex strain contractor resources and hamper the effectiveness of both reviews. Following the most recent restart of W62 activities, NNSA finally made changes to its NESS Process Guide to better coordinate these two reviews.

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 the production, maintenance, refurbishment, dismantlement, evaluation, and storage of certain components of nuclear weapons. Production activities include the manufacture or re-manufacture of unique nuclear weapon components. The Board's most recent efforts to improve safety at Y-12 were concentrated in the areas of preparations for processing of highly enriched uranium, criticality safety, maintenance, nuclear material storage, fire protection, and limits on combustible loading.

Readiness for Hazardous Operations. The Board continued to review the readiness preparations for resumption of hazardous activities at Y-12. Results of a operational readiness review by the contractor in late 2002 indicated that line management preparations for wet chemistry operations in Building 9212 were deficient in the areas of procedures, training, and conduct of operations. The Board monitored both the contractor's effort to correct these areas and the operational readiness review completed by NNSA in February. Results from the NNSA review indicated that adequate improvements had been made; NNSA authorized restart of wet chemistry operations in March of 2003. While restart of wet chemistry operations with enriched uranium has been greatly drawn out due to numerous equipment failures, these operations have been conducted in a manner that adheres to conduct of operations principles. The Board also provided safety oversight of operational readiness reviews for start-up of a special material packaging operation in Building 9720-5. Line management preparations in this case were generally satisfactory. These two readiness efforts exemplify the pre-operational reviews that will be needed at Y-12 in the future.

Conduct of Operations. The Board found that numerous operational errors implied a serious decline in proper conduct and formality of operations and in overall safety culture. Examples included failure to use required procedures in moving and storing nuclear material, failure to report equipment deficiencies or events, non-conservative decisions, and poor control of maintenance work. In September 2003, the Board was briefed by senior site office and contractor managers on plans to improve operations. A project execution plan, defining the specific tasks to be accomplished, was issued in December and, if carried out fully, should improve conduct of operations.

Building 9212 Safety Systems. The Board reviewed implementation of the Operational Safety Requirements for enriched uranium operations in Building 9212. In an October letter to NNSA, the Board questioned whether several sprinkler systems met current standards and whether Y-12 had justified the upgrading of a sprinkler system from safety-significant to safety-class. In response, the Y-12 site office committed to identify and evaluate differences between the code of record and new fire safety codes and to document an evaluation for the upgraded sprinkler system. The Board's letter also noted that three organic phase separators used in wet chemistry processes required operator action to ensure safe operation. DOE intends to complete modifications to two phase separators for passive self-decanting and confirm the adequacy of the third.

The wet chemistry area of the B-1 Wing in this building lacks a fixed fire suppression system. While wet chemistry operations were authorized to be restarted with controls considered adequate for short-term operations, the Board suggested in 2002 that NNSA consider installation of a fixed fire suppression system to provide long-term protection for the structure and workers. In response, NNSA stated that a decision would be made by April 2003 on whether to proceed with planning and budgeting for a project to provide fixed fire suppression for B-1 Wing. This decision was not made, and the Board pressed for progress on the matter with NNSA management. In September, NNSA informed the Board that quantities of combustible organic liquids were being further restricted, that certain mitigative options were under review, and that a decision on a path forward would be made in early 2004.

Criticality Safety. The Board has continued its oversight of criticality safety practices at Y-12. In a letter to NNSA in late 2002, the Board maintained that Y-12 was not placing sufficient emphasis on simplifying and standardizing the dozens of different containers and various postings for storage arrays. The Board urged NNSA to standardize storage conditions, requirements, postings, and containers to ensure that facility operators could understand and comply with criticality safety criteria. In response, NNSA reduced the amount of stored nuclear materials and has begun to standardize the storage containers used for fissile material.

Excess Combustible Materials. The Board observed a substantial excess of combustible materials and generally poor fire safety housekeeping in several Y-12 facilities. Locations included sections of Buildings 9201-5, 9212, 9204-4, and 9204-2. DOE took corrective actions in each of the facilities. The Y-12 contractor recognized the need for an aggressive program to minimize combustibles and improve overall housekeeping, and was initiating such a program at year's end.

Storage of Depleted Uranium Chips. An inquiry by the Board revealed that depleted uranium machine chips had been stored in Building 9204-4 in an unsafe configuration for years. Several drums were not vented, as required, and the potential existed for chips being stored in a dry environment. Near-term corrective actions planned by Y-12 management included venting of the unvented drums using a remotely-operated brass punch and then inspecting the drums for evidence of water. The Board noted, however, that planning for the venting project had not taken into account lessons learned from a similar drum-venting operation at another DOE site where the venting resulted in a fire. As a result, Y-12 incorporated into its work plan electrical grounding of the drums and extra preparations for fire response. The drums were safely vented in December 2003. The site also took action to verify that there are no other similar storage situations existing at Y-12 and reemphasized the protocols for storage of pyrophoric chips.

Glovebox Explosion. In May, an explosion and fire occurred in a Building 9202 glovebox during development testing of a process for uranium metal production. The contractor's analysis of the explosion identified corrective actions, including adequate process safety analysis, equipment design reviews, and start-up testing protocols. The Board reviewed the proposed corrective actions and characterized them as imperative for proper safety management of research and development activities beyond bench-scale testing.

Uranium Storage Facility. The Board continues to review the design of the Highly Enriched Uranium Materials Facility (HEUMF) for long-term uranium storage at Y-12. The Board's constant oversight of this project has led the contractor to adopt a safety-grade, filtered ventilation system and design a stronger foundation.

Oxide Conversion Facility. Y-12 is in the final stages of preparing for start-up of the Oxide Conversion Facility in Building 9212. The Board recently reviewed the operation and found weaknesses in the functional classification of safety controls, uncertain weld quality, and an unanalyzed criticality safety scenario. The Board has communicated these concerns to site personnel for action and will ensure that appropriate actions are taken prior to start-up.

2.1.3 Savannah River Site

Tritium Facilities Modernization and Consolidation. This project was undertaken to update processing capabilities and reduce the tritium facilities' operating cost. In 2003, DOE conducted an operational readiness review for five major systems installed in Building 233-H. The Board identified inconsistencies between the contractor and NNSA plans of action for this review and found deficiencies in the basis upon which the scope of the review depended. NNSA corrected these problems to the Board's satisfaction.

Software Quality Assurance. During a review of SQA, the Board noted a significant number of errors and omissions in the software specification for safety-significant worker protection systems. Errors included permitting the use of non-safety-grade computers to change software setpoints and control safety-significant field hardware, thus violating the integrity of a safety-significant system. SRS agreed to correct the problems the Board had identified.

2.2 SAFE CONDUCT OF STOCKPILE STEWARDSHIP

Stockpile stewardship is the term used by NNSA to refer 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 stockpile. Stockpile stewardship includes using past nuclear test data in combination with future non-weapon 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 Recommendation 2002-2

Safe operations in the nuclear weapons complex depend directly upon the technical abilities of the scientists and engineers at the nuclear weapons laboratories. These individuals apply unique expertise to ensure the safety of weapons operations. The safety information generated at the laboratories is of little use, however, unless it is disseminated effectively to relevant sites. Clear lines of communication are vital to ensure that safety issues raised at any facility are properly routed to the laboratories for resolution, timely answers are developed, and critical information is then transmitted for use throughout the complex.

Responding to Recommendation 2002-2, the Secretary of Energy affirmed that support for the nuclear weapons stockpile remains the highest priority at the national laboratories assigned to this work. NNSA directed each defense laboratory to establish single points of contact for safety issues affecting each weapon for which they are responsible and to certify processes for selection, training, mentoring, and succession planning for these positions. In parallel, the NNSA directed each site office to take steps to ensure that requests for laboratory support are tracked and met. These steps must include provisions to resolve priority conflicts. Related actions to implement the Recommendation included a redrafting of DOE Order 5600.1[6] to clarify roles and responsibilities defined in the order and issuing policy guidance to confirm the priority of the work supporting the nuclear weapon stockpile.

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[6] *Management of the Department of Energy Weapon Program and Weapon Complex* (1979).

In one recent instance, these changes led to the timely resolution of a resource conflict at LANL so that stockpile support work received suitable priority.

2.2.2 Los Alamos National Laboratory

Los Alamos National Laboratory, located in New Mexico, is the NNSA weapons laboratory with the largest number of defense nuclear facilities and weapon-related activities. Major projects under scrutiny by the Board include a program for certifying the safety and reliability of nuclear weapons in the absence of nuclear testing and the development of a limited-scale manufacturing capability for replacement pits. In 2003, the Board focused its attention on the Pu-238 Scrap Recovery Line, work planning, lightning protection, design of safety controls, stabilization of nuclear materials, and fire protection.

Scrap Recovery Line. LANL has almost completed construction of a new aqueous processing line for recovery of scrap Pu-238. Based on current plans, the new line will be the only source of purified Pu-238 for at least the next decade. The Board previously found significant deficiencies in the safety basis and safety controls for this facility. LANL personnel revised the process hazards analysis and developed more reliable controls. However, the Board's review of the revised analysis disclosed that not all safety issues had been identified and fully explored, suggesting the need for new safety controls. Additional attention to this matter will be required in 2004.

Work Planning. The Board reviewed LANL's process for identifying hazards, describing controls, and authorizing work, and concluded that complete identification of significant hazards and practical controls does not always occur. Improvements are needed in the involvement of subject matter experts, training, and use of engineering standards in programmatic work. To that end, LANL is revising its work planning requirements.

Weapons Engineering Tritium Facility. Previously the Board had noted that although the lightning protection system at the Weapons Engineering Tritium Facility had been designated as safety-class (important for the protection of the public), there were numerous physical deficiencies in system components. In a recent review, the Board discovered that not all deficiencies had been corrected, and the system still did not meet normal industrial standards. LANL engaged two subject matter experts to determine whether the existing lightning protection system, if properly maintained, could meet its safety requirements. The experts' opinion was that the existing system could not fully perform its safety-class function. LANL is developing a plan to modify the system.

TA-18 Safety Class Controls. In a letter dated July 19, 2003, the Board objected to LANL's failure to follow DOE requirements for new safety-class equipment. The primary concern was that credible single failures would prevent the required safety actions. The Board also questioned the technical feasibility of the approach that NNSA had directed, namely, to monitor the temperature of the nuclear material and automatically shut down nuclear assemblies under certain circumstances. Further reviews are planned to determine the adequacy of LANL's corrective actions.

Recommendations 94-1 and 2000-1. In these related Recommendations, the Board encouraged DOE to stabilize and safely store nuclear materials. LANL has been the least responsive site with regard to this important task, due in part to inadequate funding by DOE. On August 5, 2003, a serious incident occurred that could have been prevented had DOE and LANL been more responsive to these two Recommendations.

Fire Protection. LANL conducted a safety review of its site-wide fire alarm system following the Cerro Grande wildfire and concluded that the system is antiquated and inadequate. DOE requested funds for upgrading the system as part of a program to mitigate impacts from the Cerro Grande fire, but on January 9, 2003, DOE rescinded some Cerro Grande funds including those allocated for the alarm system upgrade. In a letter to DOE dated January 24, 2003, the Board highlighted the negative safety implications of this action and requested a report documenting how DOE planned to ensure fire safety in light of the funding cut. DOE restored the funds in response to Congressional inquiries, but recent discussions with DOE reveal that the project schedule has slipped by 5-6 months and funding is not yet stable.

In the course of implementing Recommendation 2000-2, LANL assessed the adequacy of the remaining facility fire alarm system and the balance of the site-wide communication system. The Board is seeking from LANL an explanation regarding necessary upgrades not scheduled for completion until FY12.

2.2.3 Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL), 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 consultation on the surveillance and dismantlement of LLNL-developed nuclear weapons. Most defense nuclear activities are conducted in the Superblock complex, which includes the Building 332 Plutonium Facility and the Tritium Facility. The Board conducted several on-site reviews during 2003, focusing on the Superblock safety bases and vital safety systems, the deactivation of the Heavy Element Facility (Building 251), and the management of nuclear materials.

Defective Safety Basis. The Board reviewed the current safety bases for the Plutonium Facility (Building 332), the Hardened Engineering Test Facility (Building 334), and the Material Management Source Vault (Building 23lV). This review was supplemented by walkdowns of safety-related systems and components. In a letter dated April 10, 2003, the Board communicated to NNSA a number of inadequacies. These inadequacies included postulated accident scenarios for which unmitigated consequences had been evaluated to exceed the off-site evaluation guidelines, but for which no safety-class controls had been identified. In some cases, safety systems had been implicitly credited with performing a safety function, but had not been assigned a formal functional classification. In a response dated June 23, 2003, NNSA committed to correcting these faults as part of the new documented safety analysis. LLNL is also upgrading Building 332's Emergency Power System to meet safety class electrical codes. This system had been found deficient by the Board in connection with the reviews of vital safety systems under Recommendation 2000-2.

Deactivation of Building 251. In 2003, the Board continued its review of LLNL's plans for the deactivation of the Heavy Element Facility, Building 251 (B. 251). The deactivation of B.251 involves the removal of nearly 300 items of radioactive material, some posing a significant risk of radiation exposure to workers and potential for release of contamination in the building. Decontamination and removal of 48 gloveboxes and other equipment will require careful planning to ensure that contamination is properly controlled. The project is being carried out on an accelerated schedule to achieve near-term risk reduction and thus avoid costly safety basis upgrades. During 2003, the Board conducted reviews of final preparations for the readiness assessment for large-scale inventory reduction operations.

Despite NNSA's authorization to commence the inventory reduction campaign, inadequacies remained in ALARA[7] practices, formality of operations, and work control. Continuing safety oversight by the Board led to the engagement of expert observers during initial operations. Late in 2003, LLNL safely completed an initial campaign that removed enough inventory to meet the year-end goal of reducing the building's inventory by 80 percent (based on curie content).

Recommendation 94-1. LLNL has completed most of the stabilization and packing of material covered by Recommendation 94-1. The plutonium-containing materials are now stored in strong, welded containers that meet DOE's Plutonium Storage Standard, DOE-STD-3013. LLNL examined additional material, termed inactive, to ensure that it could be dealt with in a similar way and in a timely manner. LLNL is characterizing, stabilizing and packaging the inactive materials using the same methods and equipment used in the Recommendation 94-1 campaign.

2.2.4 Nevada Test Site

The Nevada Test Site (NTS) is located in southern Nevada, about 75 miles northwest of Las Vegas. Stockpile activities at NTS include test readiness preparations, disposition of damaged nuclear weapons, and subcritical experiments. Underground testing of nuclear weapons is no longer being conducted at NTS. However, NTS 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 would be done safely. During 2003, the Board focused its attention on NTS's test readiness posture, capability to dispose of a damaged nuclear weapon, to undertake subcritical experiments, and to conduct transuranic (TRU) waste operations.

Underground Testing. In 2002 the Board had found weaknesses affecting NNSA's ability to conduct safely an underground nuclear weapons test. The number of personnel qualified to plan and conduct underground nuclear weapons tests was shrinking. There was no formal safety basis for an underground nuclear weapons test, nor was there a rigorous process to assess the safety of such a test. During its 2003 review of NTS's current test readiness posture, the Board found an improved capability to resume testing. NNSA implemented a plan to prepare a safety basis, stem the loss of experts, improve the state of readiness of facilities and equipment,

[7] "ALARA" refers to a radiation protection program based on the principle of reducing exposures to a level "as low as reasonably achievable."

and develop a readiness review process compliant with NNSA requirements for nuclear explosive operations. The Board observed improvements in personnel, facilities, equipment and training.

Damaged Weapons. The Board continued to press for a program and infrastructure to safely dispose of a damaged or improvised nuclear weapon.[8] During 2003, the Board reviewed safety basis developments, infrastructure improvements, practices, procedures, and training. NNSA continued to make physical improvements to G-Tunnel, and conducted training on the full scope of disposition activities at NTS. The Board provided feedback on the developing safety basis and pointed out that the conduct and formality of operations needed significant improvement. To accomplish this, NNSA plans to complete the safety basis, strengthen conduct of operations, develop specific procedures for disposition operations, and conduct training.

Subcritical Experiments at NTS. After reviewing the Joint Actinide Shock Physics Experimental Research facility at NTS, the Board concluded that the quantity of nuclear material in the targets would exceed the threshold values for a Hazard Category 3 nuclear facility. However, NTS personnel had not developed safety controls appropriate for this level of hazard. As a result of a July 2001 letter from the Board, a visit by the Board to NTS in April 2002, and numerous other communications, the contractor designed controls adequate for the safety of this operation. In 2003, the Board reviewed and found adequate the controls and configuration management for experiments with plutonium.

Safety Basis Reviews. The Board reviewed the safety basis for the Device Assembly Facility, U1a Complex and Subcritical Experiments, Area 5 Radioactive Waste Management Complex, and G-Tunnel. While the Board found that the safety bases had improved, they were nonetheless faulty in several respects, including use of an incorrect methodology in a hazard analysis, inadequately developed safety controls, incomplete description of the scope of some activities, incompletely analyzed operations, and erroneous classification of safety controls. Corrections are underway.

Electrical and Lightning Safety. In 2003, the Board reviewed electrical and lightning protection and detection systems for the U1a Complex, Device Assembly Facility, G-tunnel, and the Joint Actinide Shock Physics Experimental Research facility. Several facilities at NTS perform operations in which special nuclear material is collocated with significant quantities of high explosives, and operations of this kind could commence with little or no warning. However, the Board observed that not all of the facilities that could potentially house these operations are currently equipped with adequate lightning detection capabilities or well-documented lightning protection controls. Two workers were struck by lightning at the U1a Complex in 2002 because lightning warning was insufficient. NNSA increased the distance for lightning warning but did so without adequate technical basis and due consideration of other warning and protection mechanisms. The Board informed NNSA it would be prudent to establish compensatory measures to mitigate potential lightning hazards until code-compliant lightning detection and protection programs have been adequately implemented.

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[8] An improvised nuclear weapon produces explosive yield from nuclear fission. Such devices may be fabricated in a completely improvised manner or may result from a modification to a U.S. or foreign nuclear weapon.

3. NUCLEAR MATERIALS PROCESSING AND STABILIZATION

3.1 STABILIZATION AND STORAGE OF REMNANT MATERIALS

3.1.1 Complex-Wide Program

Research and Development Funding. Recommendation 94-1 stressed the importance of establishing a research program to close gaps in the technical bases for safe interim storage and long-term disposition of fissile materials. DOE's Implementation Plan for Recommendation 2000-1 noted the contributions made by its research and development program in providing technical support for site operations to safely stabilize, package, and store plutonium. DOE's standard for handling plutonium, DOE-STD-3013,[9] which establishes requirements governing the long-term storage of plutonium metal and oxides, relies on several research and development programs, including the Materials Identification and Surveillance Program, to ensure the long-term safety of stored packages containing plutonium-bearing materials.

In early 2003, the Board discovered that the budget DOE submitted to Congress had eliminated funding for the 94-1 research and development program in Fiscal Year 2004 and beyond. In a letter to DOE dated March 20, 2003, the Board pointed out that significant reductions in research and development could make it impossible to verify safe storage parameters as required by DOE-STD-3013. In response, the Assistant Secretary for Environmental Management, in a letter dated May 27, 2003, committed to restore funding for this program.

Deactivation of F-Canyon. The Board has urged DOE on several occasions to ensure that clear and achievable stabilization and disposition paths are available for fissile materials remaining in the defense nuclear facilities complex. In 2002, DOE began the deactivation of the F-Canyon facility at SRS, thereby removing from service one disposition path. To assess the wisdom of this course of action, Congress mandated in FY03 legislation that the Board and DOE certify that the capabilities of the F-Canyon facility were no longer needed and that all processing needs could be met by using the H-Canyon facility at SRS or by alternative means.

In early 2003, staff members of the Board and DOE provided briefings on F-Canyon to representatives of the Office of Management and Budget and to staff members of the South Carolina Congressional delegation and the Armed Services Committees of the House and Senate. Following these briefings, Congress deleted the requirement for the Board to certify the need for further utilization of F-Canyon; DOE is still required to provide such a certification, which it has not yet done. Meanwhile, many metric tons of plutonium and uranium materials under the control of DOE's Office of Environmental Management lack clearly defined disposition paths.

3.1.2 Plutonium

Overview. In response to Recommendations 94-1 and 2000-1, DOE committed to stabilize and package its legacy plutonium materials. Significant progress has been made toward

[9] *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials* (September 2000).

meeting this commitment at some sites. Rocky Flats completed stabilizing and packaging all of its plutonium metal and oxide into durable, sealed containers complying with DOE-STD-3013. At Hanford's Plutonium Finishing Plant, most activities committed to in the Implementation Plan for these Recommendations have been completed, including the stabilization and packaging of plutonium solutions, alloys, polycubes, and residues. Facility operators completed packaging of plutonium metal items in containers compliant with DOE-STD-3013, but weld porosity problems led DOE to conclude that 358 of the cans require further evaluation with digital radiography. Cans found to have unacceptable porosity will be rewelded. This work is planned to be completed no later than May 2004. Also during 2003, SRS started up plutonium oxide stabilization furnaces and a packaging system for its plutonium oxides and metals.

Unfortunately, other sites have missed or will likely miss milestone dates for completion of Implementation Plan commitments. LLNL missed the milestone to complete stabilization and packaging of excess plutonium and uranium during 2003. Oak Ridge National Laboratory (ORNL) has again missed the milestone to disposition 701 grams of Pu-238 and 132 grams of surplus Plutonium (Pu)-239.

LANL. The protracted stabilization program at LANL remains a concern. Approximately 3,000 excess items and 1,500 programmatic items remain to be stabilized and repackaged. Managers at LANL have completed a revised project execution plan for the stabilization program. However, the schedule is still based on the July 2002 revision of the Implementation Plan for Recommendation 2000-1, a plan rejected by the Board because it extended the schedule to 2010.

Despite the slow pace, LANL continues to make progress in repackaging programmatic materials and stabilizing certain residues. The most encouraging development at LANL during 2003 was the successful initiation of a program to discard low-assay plutonium residues rather than expend resources on processing them to recover small quantities of plutonium. In correspondence to DOE dating back to 1999, the Board had suggested that such a strategy could significantly accelerate the stabilization program at LANL.

Hanford Oxides. During 2003, the Board evaluated a Hanford proposal to stabilize plutonium oxides containing chloride salts at a lower temperature than established by DOE-STD-3013. This request was based on achieving technical equivalency with the standard's requirements for allowable moisture. Initially, Hanford proposed performing stabilization at 750°C, measuring weight loss at 600°C, and then inferring the moisture loss that would occur up to 1000°C. The Board maintained that there were insufficient technical data to support DOE's assertion that essentially all sample weight loss above 750°C would be due to volatilization of compounds other than water. DOE subsequently revised its approach to measure moisture loss up to 1000°C and to re-stabilize the material in the event that total sample weight loss exceeded the allowable limit. Stabilization of plutonium oxides containing chloride salts has commenced and is expected to be completed before May 2004, the date committed to in the Implementation Plan for Recommendations 94-1 and 2000-1.

The Board reviewed DOE's plans to recover and dispose of 12 drums at Hanford containing high concentrations of Pu-238 oxide. This material is thermally hot due to the high

specific activity of Pu-238 and will pose a significant radiological hazard during the recovery and handling of the drums. In early 2003, the Richland Operations Office requested technical assistance from DOE Headquarters to help with the difficulties of handling these drums, but the request was denied for lack of resources. To date, DOE has yet to develop a viable plan for the safe recovery and handling of these drums. On November 7, 2003, the Board issued a letter to DOE requesting such a plan.

3.1.3 Uranium

Highly Enriched Uranium. Operators at SRS met the commitment in the Recommendation 2000-1 Implementation Plan to begin downblending solutions of highly-enriched uranium. The low-enriched uranium solution resulting from this activity is being shipped offsite for fabrication into fuel for commercial power reactors.

Building 3019 at ORNL. In July 2003, the Board found weaknesses in the documented safety analysis (DSA) submitted to DOE for Building 3019 at ORNL. This building currently serves as the national repository for Uranium (U)-233. The ORNL contractor agreed to make certain changes including (1) revising the process used in the DSA for evaluating and screening toxicological and radiological hazards to comply with current standards, (2) designating the high efficiency particulate air filters in the Vessel Offgas System as safety-significant equipment, (3) adding a Limiting Condition of Operation for operability of the Vessel Offgas System, and (4) adding a Technical Safety Requirement to ensure that the cell covers, which provide a safety-class function for radiological confinement. The Board believes these changes will significantly enhance the safety of storing U-233 in this aging facility.

U-233 stored in Building 3019 was the primary concern of Recommendation 97-1. The Phase 1 container inspection program defined in DOE's Implementation Plan for this Recommendation has been completed, and DOE has selected a contractor to safely process these materials as part of a Medical Isotope Program. All deliverables from the Recommendation 97-1 Implementation Plan have now been completed.

DOE is taking action in response to a letter issued by the Board in September 2002 regarding the safe storage of sodium fluoride traps in Building 3019. These vessels, which store Uranium (U)-233 hexafluoride recovered from the Molten Salt Reactor Experiment, are being subjected to increasing internal pressure from radiolytic gas production. ORNL has now completed depressurizing all but one of the 26 traps as an interim measure and is monitoring the relatively low pressure in the remaining trap until it can be depressurized.

Depleted Uranium. The plutonium production mission at SRS required large quantities of depleted uranium to be fabricated into targets, irradiated in reactors, and subsequently processed through chemical separations facilities. During approximately 40 years of plutonium production, a significant inventory of depleted uranium trioxide and metal accumulated at SRS. On March 7, 2002, the Board issued a letter urging DOE to correct unacceptable storage conditions and to develop an integrated plan for disposing of this excess material. DOE replied on December 20, 2002, with a project plan for dispositioning these materials.

Overpacking of severely degraded drums now has been completed, and DOE is on track to dispose of these materials by the end of 2004. All 2,735 metric tons of depleted uranium metal has been shipped to Envirocare, a commercial low-level waste facility in Utah, for disposal, along with 2,000 metric tons of depleted uranium trioxide. By December 2003, contracts were either in place or pending approval for the off-site disposal of the remaining 18,000 metric tons of depleted uranium trioxide, 260 metric tons of low-enriched uranium oxide, and 186 metric tons of depleted uranium solutions by the end of 2004.

3.1.4 Special Isotopes

Slurry Transfer at SRS. The Board reviewed DOE plans for transferring 30,000 gallons of slurry containing 148,000 curies of americium and curium from F-Canyon to a high-level waste tank (Tank 51) in H-Area for subsequent vitrification in the Defense Waste Processing Facility at SRS. This complicated inter-area transfer required extensive coordination between F-Canyon, F-Area Tank farms, and H-Area Tank farms. The Board suggested improvements for handling contingencies associated with a potential loss of active ventilation in H-Area Diversion Box 8 and encouraged integrated test-runs with surrogate slurry materials. DOE incorporated the Board's comments into the control strategy and preparatory activities for the transfer. On January 28, 2003, the contractor safely and successfully completed the transfer.

Hanford Cesium and Strontium. The Hanford Waste Encapsulation and Storage Facility holds approximately 100 million curies of cesium and strontium salts in doubly contained capsules. DOE has proposed to transfer these capsules from the storage pool into dry storage in shielded containers on a storage pad. The Board's review of the project's plans revealed that DOE's approval of safety design criteria was not going to be obtained, in contravention of 10 CFR Part 830 and the Radioactive Waste Manual.[10] DOE has directed the contractor to correct this error.

3.1.5 Inactive NNSA Nuclear Materials

Overview. The Board continues to believe that NNSA must improve its management of inactive nuclear materials. In a letter dated December 31, 2002, the Board pointed out deficiencies in nuclear materials management that were not adequately addressed in NNSA's letter to the Board dated September 17, 2002. The principal deficiencies involved characterization of materials for storage or disposition, identification of materials having no defined future use, and analysis and upgrading of materials packaging and storage facility conditions. In a response to the Board's letter on February 7, 2003, NNSA reported the formation of an Inactive Actinides Working Group (IAWG).

The IAWG has developed a strategy for achieving improvements in three distinct areas: (1) Acceptance and Retention of Nuclear Materials, (2) Materials Characterization and Storage Adequacy, and (3) Disposition. The IAWG made progress toward achieving these goals by preparing an update to the Nuclear Materials Inventory Assessment Guide. This guide recommends classifying all nuclear materials as "needed" or "unneeded," providing justification

[10] DOE M 435.1-1 (1999).

for continued storage, ascertaining the adequacy of characterization of materials needed for continued storage, and developing a disposition path for all unneeded inactive actinide materials.

Specific Facilities. The Board reviewed the packaging, storage, and disposition plans for inactive nuclear materials at LLNL, Sandia National Laboratory, LANL, and Y-12. These sites continue to house substantial inventories of active (programmatic) and inactive nuclear materials that represent a potential hazard to the workers, the public, and the environment. NNSA will need to support the efforts of the IAWG to repackage or otherwise dispose of materials in configurations unsuitable for long-term storage.

At Y-12, the Board reviewed the nuclear materials management program and evaluated the steps taken in response to the Board's letters of May 20, 2002, and December 31, 2002. The Board's close oversight of this program spurred NNSA to release funds making it possible for Y-12 to begin disposing of material no longer needed to support site missions. Environment, safety, and health vulnerabilities will be reduced by the near-term disposition of combustibles contaminated with highly enriched uranium, its residues, and excess depleted uranium.

3.2 STABILIZATION OF SPENT NUCLEAR FUEL

3.2.1 Hanford Site

The Board continues to place a high priority on its oversight of the Spent Nuclear Fuel Project (SNFP) at Hanford's K-Basins. DOE has reduced risk significantly by removing approximately 70 percent of the spent fuel from the K-Basins. K-Basin workers removed approximately 55 percent of the fuel from the K-East Basin, where fuel degradation has generated about 42 cubic meters of highly radioactive sludge. Continuing equipment problems are hindering the efficient removal of the remaining fuel. The contractor was unable to meet the milestone in the Implementation Plan for Recommendation 94-1 to begin sludge removal from the K-East Basin in December 2002 and has yet to do so.

The fuel retrieved from the K-Basins is cleaned, dried, and sealed in Multi-Canister Overpacks (MCOs). The MCOs initially are mechanically sealed as an interim measure, and then are permanently welded shut. When the Board suggested that the lack of capability to perform the required closure weld on the MCOs was a significant vulnerability, DOE chose in early 2003 to implement such a system. Shortly after welding became available, an MCO with a leaking mechanical seal was identified. With technical oversight from the Board, DOE opted to promptly weld the leaking MCO (in contrast with a previous instance, when a leaking MCO had been inserted in an overpack storage tube, a less desirable solution). All MCOs in storage now have mechanical or welded seals that have passed the required leak tests.

In its letter of March 7, 2003, the Board pointed out deficiencies in the preparations for start-up of the system to transfer fuel between basins. Neither DOE nor contractor oversight was effective in identifying and correcting these problems. Additional reviews by both the Board and DOE identified significant weaknesses in the authorization basis and procedures, leading the contractor to delay its operational readiness review (ORR) for the K-East Basin Sludge Water System several times in early 2003. The contractor's ORR finally began in April 2003 but was

terminated because of significant deficiencies in procedures and training, problems in the system's technical basis, and overall poor performance by project management.

Subsequent reviews by the Board revealed programmatic breakdowns in the areas of configuration management, conduct of engineering, conduct of design, project management, and project oversight. The Board noted that self-assessment by the project was not effective and that lessons from these failures were not passed on to other SNFP activities. For example, the Board reviewed fuel transfer operations and design modifications and found problems with configuration management of safety documents and implementation of the Unreviewed Safety Question process. DOE representatives reviewed the Fuel Transfer System and identified additional safety basis and design issues. The extent of the problems led DOE to conclude that integrated safety management (ISM) is not adequately implemented for this project.

The extensive problems described above have made it impossible for DOE to meet the commitment in the Implementation Plan for Recommendations 94-1 and 2000-1 to complete removal of sludge from the K-Basins by August 2004. In a letter dated April 10, 2003, before the true extent of these problems had been acknowledged by DOE, the Board requested that DOE provide a clear path forward for meeting the completion date in 2004 or provide a revised implementation plan with a justification for the delay. DOE's reply admitted that the schedule and path forward for sludge removal are no longer clear. DOE is now considering developing a new approach to processing the sludge for disposal and leaving most of the sludge in the basins in the interim, with some risk reduction actions taken. This approach would likely add several years to the sludge removal schedule.

3.2.2 Savannah River Site

During the last few years, DOE has been consolidating storage of spent nuclear fuel at SRS into the L-Basin facility. DOE completed the emptying of the K-Basin in the fall of 2002 and implemented a safe shutdown and deactivation plan to minimize the need for surveillance and maintenance. In October 2003, DOE completed the removal of spent nuclear fuel from the Receiving Basin for Off-Site Fuel and developed a similar safe shutdown plan for this facility. Once this plan is implemented, surveillance will be limited to inspection of basin water level and periodic inspection of the waste cell. All foreign and domestic research reactor fuel will now be received and stored at L-Basin.

In December 2003, DOE completed the dissolution of the last Mark 16/22 spent nuclear fuel bundle. This achieves the milestone in the Implementation Plan for Recommendations 94-1 and 2000-1 for stabilizing spent nuclear fuel at SRS. The campaign began in July 1997 and resulted in stabilization of 1,170 fuel assemblies.

3.2.3 Idaho National Engineering and Environmental Laboratory

The Board reviewed operations to dispose of spent nuclear fuel at the Idaho National Engineering and Environmental Laboratory (INEEL). Idaho site workers completed the transfer of 2,425 pins of spent nuclear fuel from the Power Burst Facility reactor pool to dry storage in the Irradiated Fuel Storage Facility, located in the Idaho Nuclear Technology Engineering

Center (INTEC). DOE completed this action in September 2003, in advance of the commitment in the Idaho Settlement Agreement. This achievement consolidates nearly all of the Idaho spent fuel at INTEC where it may be dried and packaged in standard containers for shipment to the planned geologic repository at Yucca Mountain. The final items to be transferred are six dry casks containing commercial fuel from earlier rod consolidation testing at Test Area North. The contractor plans to ship these casks to INTEC in 2004.

3.3 WASTE MANAGEMENT

3.3.1 High-Level Waste

Tank Integrity. Based on guidance provided by the Board in a 2002 letter, DOE extended the high-level waste (HLW) tank inspection program at SRS to require ultrasonic inspection of all double-shell tanks. Previously, DOE had proposed a 9-year schedule for inspecting all the double-shell tanks at SRS. When the Board pointed out the potential for corrosion in this long time period, DOE accelerated the inspection schedule. The initial inspection of all double-shell tanks at SRS is now scheduled to be completed before the end of fiscal year 2006.

Accelerated Salt Waste Disposition at SRS. DOE has attempted to accelerate the stabilization of salt waste at SRS using on-site disposition of saltcake after limited processing. Saltcake is generated by the precipitation of materials during the concentration of HLW solutions in the three HLW evaporators, and contains smaller concentrations of fission products and actinides than the concentrated HLW liquid and sludges. One option being considered is to make use of a planned salt waste processing facility designed to decontaminate concentrated HLW liquids. This facility would be capable of decontaminating saltcake; however, the schedule and capacity of this facility are based on the assumption that most saltcake will be disposed of by other means. It will not be operational until 2009, and it is not clear whether the current design throughput will be sufficient to meet the site's closure goals.

The Board has continued to encourage DOE to avoid excessive reliance on optimistic predictions of unproven technologies and initiatives, to systematically and realistically assess the technical and regulatory risks associated with its plans for disposing of salt waste, and to develop strategies to mitigate identified risks. Toward these ends, the DOE Implementation Plan for Recommendation 2001-1 committed DOE to submit to the Board by August 2003 a programmatic risk analysis for the salt processing program, as well as an evaluation of the progress on the saltcake disposition effort. DOE was unable to meet this deadline. The Board will continue to insist that DOE expedite completion of these tasks.

SRS Tank Farms. In 2003, the Board sought to reverse a marked and worrisome increase in inadvertent waste transfer events at the HLW tank farms. Causes included operator errors, inadequate procedures, and equipment malfunctions. With the Board's oversight, the tank farms contractor developed corrective actions in conduct of operations, equipment conditions, and work practices. The corrective actions included additional operator training, a review of siphon evaluations for each waste transfer by an experienced engineer, maintaining a record of the operability of transfer equipment, and verifying siphon break design features in

equipment. Changes are also being made in transfer control procedures and other documents to help prevent inadvertent transfers.

INEEL Tank Closure Preparations. Preparations for closing high-level waste tanks at INEEL are on schedule. INEEL operators successfully washed and sampled two additional HLW tanks in preparation for grouting and closure, consistent with the closure plan submitted to the Idaho Department of Environmental Quality. This increases to four the number of tanks in seismically vulnerable pillar-and-panel vaults ready for closure. The fifth tank is expected to be washed and sampled by spring 2004.

Hanford Tank Farms. The Board continued to oversee activities at the Hanford HLW tank farms, conducting reviews in areas such as work planning and safety analyses for waste retrieval activities, conduct of operations, training, and feedback and improvement. Examples follow.

- **Tank Integrity:** In response to an earlier request by the Board for action to remediate corrosion in double-shell HLW tanks, the tank farms contractor sought to adjust waste chemistry. In April 2003, corrosion inhibitors were added to double-shell tank 241-AN-107. This action was accomplished in support of a DOE commitment to the Board to correct the chemistry for four double-shell tanks.

- **Waste Feed Delivery:** In a letter to DOE in September 2002, the Board found fault with the uncertainty in the analysis to determine the minimum design pressure of the waste feed delivery transfer system. DOE responded by initiating a technical evaluation to confirm that the analysis and assumptions support the design. In 2003, the tank farms contractor prepared an action plan responding to the recommendations in this evaluation, and undertook additional waste characterization and engineering studies.

- **Safety Basis for Tank Farm Operations:** The Board reviewed the DSA for the tank farms, prepared to comply with 10 CFR Part 830. Responding to the Board's questions on the use of less-than-bounding factors in the analysis, DOE conducted an assessment and found that the estimate of the bounding source term for design basis accidents was incomplete. To remedy this, a more conservative factor was used to calculate the radiological consequence of the flammable gas accident scenario in the final safety analysis. DOE also modified the Technical Safety Requirements for the tank farms to explicitly require the use of process control plans for activities that can induce flammable gas release from the wastes.

- **Waste Retrieval:** The Board reviewed safety basis documents, plans, and procedures that had been prepared for the retrieval of high-level waste by sluicing, acid dissolution, and vacuum retrieval, and supplemented this review by observing sluicing and acid dissolution in the tank farms. The Board shared observations from the reviews with DOE and contractor personnel, and subsequently observed improvements where deficiencies had been identified. In particular, the Board has noted improved operator training and testing, and training for supervisory personnel.

3.3.2 Low-Level and Transuranic Waste

Waste Isolation Pilot Plant. The Waste Isolation Pilot Plant (WIPP) is a geologic repository utilized for the disposal of defense TRU wastes. WIPP received its first waste shipment on March 25, 1999. During 2003, the site received and deposited in the underground repository more than 800 shipments totaling in excess of 8,000 cubic meters of contact-handled TRU waste. The Board monitored operations at WIPP to assure that worker safety would be protected as the facility moved toward full production. The Board plans to review in depth the preparations for disposal of higher hazard, remote-handled TRU waste.

Idaho National Engineering and Environmental Laboratory. The Board issued a letter on March 7, 2003, identifying the absence of activity-based hazard analyses for the retrieval of transuranic waste containers. In response, the DOE Idaho Operations Office imposed the requirement that respirators be worn by the work force at the Advanced Mixed Waste Treatment Project until justification could be provided to relax this control. In November 2003, the contractor submitted an exposure assessment report intended to justify removing the requirement for respiratory protection. The report describes an extensive personnel and area monitoring program that was conducted during the retrieval of 600 waste containers. No significant chemical or radiological contaminants were observed during the monitoring program.

Melton Valley Transuranic Waste Treatment Project. The Melton Valley Transuranic Waste Treatment Project at ORNL is designed to process liquid and solid TRU waste and low-level radioactive waste, including high-activity low-level wastes, for offsite disposal. The Foster Wheeler Environmental Corporation designed and constructed the project under a DOE privatization contract. Foster Wheeler will operate the facility and decommission it when its mission is complete.

Due to the hazards posed by high activity of substantial portions of the TRU and low-level wastes to be processed by this facility, the Board closely examined the design and construction of the project's Valley's Waste Processing Facility and the preparation of its documented safety analysis. Due to regulatory delays in WIPP's readiness to receive remote-handled TRU waste, initial operations will be restricted to the processing of supernate from the Melton Valley Storage Tanks for disposal at NTS as high-activity low-level waste. A Foster Wheeler ORR and a DOE Oak Ridge line management assessment of readiness were completed in late 2003. An ORR conducted by DOE headquarters is scheduled for early 2004.

Hanford. At Hanford, the Board reviewed plans and safety documents associated with the retrieval of drums of TRU waste from soil-covered trenches. Among the approximately 38,000 drums to be recovered are many that will likely be unmarked, unvented, and in poor physical condition. The Board focused its review on the controls to prevent the spread of contamination and potential uptakes of airborne contamination by workers. The Board found that the controls proposed by the contractor were not commensurate with the hazard presented by the worst-case accident scenario. The Board informed DOE of its concerns, and in response, DOE directed the contractor to strengthen the control set. Operators at the Hanford burial grounds began retrieval operations in late 2003.

3.4 FACILITY DEACTIVATION AND DECOMMISSIONING

3.4.1 Overview

Fires, personnel contaminations, and other accidents continue to occur during deactivation and decommissioning (D&D) of defense nuclear facilities. The Board is concerned about increased risk to the workers, the public and the environment caused by inadequacies in DOE's oversight of these activities and its increasing reliance on contractors to ensure safety. The Board analyzes each accident, and for the more serious events requests a briefing from DOE officials to better understand the causes of the accident and probe the efficacy of solutions.

3.4.2 Ohio Field Office

DOE's Ohio Field Office is responsible for the cleanup of the Fernald and Miamisburg (Mound) Closure Sites. Work at these sites has been progressing on or ahead of schedule, but experienced DOE and contractor personnel are leaving as the completion date of 2006 draws nearer. The Board recognizes the need for DOE to consolidate resources as work at these sites is completed, but such consolidation cannot be allowed to reduce prematurely necessary federal oversight of contractor work. The Board has informed DOE of this concern and is continuing to monitor safety at Fernald and Mound.

3.4.3 Fernald Closure Project

Although the contractor is making good progress toward closure of the Fernald site by 2006, the Board observed that the number of reportable occurrences and near misses in 2002 and the first half of 2003 was on the rise. The Board's review found that many of the contractor's project and field managers believed that they had achieved adequate safety and that meeting the schedule was the top priority. The Board also noted that new workers at the site were involved in a disproportionate share of the site's injuries. From the Board's perspective, both DOE and the contractor had been slow to take corrective actions. In August 2003, the Board sent a letter to DOE documenting these and other worker safety issues.

In response to the Board's letter, DOE and the contractor took several corrective actions. First, the contractor provided additional training to field managers, emphasizing accountability for safety performance. Second, the qualifications of new workers were more closely examined. Third, workers and supervisors who did not exhibit safe work practices were replaced. Fourth, the contractor halted work on the silos and other D&D projects to evaluate safety issues and improve safety performance. Fifth, the site contractor terminated the main subcontractor on the D&D project and assumed responsibility for completing the remainder of the D&D work. The Board plans to review the D&D project when work resumes.

3.4.4 Miamisburg Closure Project

The Miamisburg Closure Project includes D&D of former radioactive materials research, development, and processing facilities at the Mound Site. The new contract for closure activities specifies accelerated cleanup and transfer of the site to the Miamisburg Mound Community

Improvement Corporation for industrial use by March 31, 2006. The tempo of site demolition and cleanup work has increased since the new contract was signed. The new contractor also has taken actions to correct weaknesses previously identified by the Board, for example, insufficient detail in work procedures. A core team of facility and project managers and safety and radiological protection personnel has also been established to review all work procedures before they are approved for use.

3.4.5 Y-12 National Security Complex

Building 9206 at Y-12, currently classified as a Hazard Category 2 facility for storage of nuclear material, is being deactivated by NNSA. In recent years, the Board sent several letters to NNSA urging action to reduce the risk from significant amounts of hazardous and radioactive materials in this facility. A particular hazard involved uranium-contaminated solutions that remained in glass extraction columns out of service since 1994. In June 2003, the contractor drained secondary extraction column liquids into bottles for interim storage. In October 2003, the bulk of the liquid in the primary extraction columns was drained, greatly reducing the uranium solution inventory. The safety benefits include reducing the likelihood of exposing the workers to radioactive material and removing a significant source term in the event of a fire.

3.4.6 Rocky Flats Environmental Technology Site

Decommissioning activities are the last of high-hazard nuclear operations at the Rocky Flats Environmental Technology Site (RFETS). RFETS is on schedule for accelerated cleanup and closure by 2006, but there have been a number of significant safety incidents in the past year. These include (1) exposure of 23 individuals in Building 776 to high levels of airborne contamination when a flow reversal occurred in the ventilation system, (2) vandalism of high-efficiency particulate air filters, and (3) a fire in a highly contaminated glovebox. The Board believes that ineffective DOE oversight and inadequate work planning contributed to these events.

The most serious of the incidents was a fire that occurred on May 6, 2003, during preparations to dismantle an atypical glovebox contaminated with plutonium in Building 371. No workers were injured, but operators who unsuccessfully fought the fire were needlessly endangered. Four firefighters received skin contamination, and a significant cleanup effort was required. The Board's initial review determined that inadequate work planning and the failure to follow procedures were key contributors to the fire. The contractor had approached this task using a standard work package that did not take into account the unique configuration of the glovebox. Furthermore, workers did not adhere to controls for combustible materials, which had been allowed to accumulate in the glovebox. The Board issued a letter on July 31, 2003, asking DOE to take immediate actions to verify that conditions which had contributed to the fire did not exist elsewhere at RFETS. DOE provided an action plan to the Board in a letter dated August 15, 2003, and inspected all of the remaining gloveboxes in Buildings 371 and 707.

The Board conducted an investigation of the fire and issued a comprehensive report on December 2, 2003. The investigation revealed that DOE's safety oversight of decommissioning activities at RFETS had been ineffective, and that there had been no coverage of D&D work in

Building 371 by DOE's Facility Representatives. The Board's letter forwarding the report identified the need for an independent review of ISM at RFETS, including an assessment of the effectiveness of DOE's health and safety oversight of decommissioning activities. The letter also established a reporting requirement for DOE to identify how the problems at RFETS would be corrected. DOE has agreed with the Board's findings, and is proceeding with its contractor to carry out intensive reviews of safety oversight and the planning and execution of work at the site. These reviews will contribute to the development of a comprehensive corrective action plan.

In the vandalism incident, 14 high-efficiency particulate air filters (relied on to prevent release of airborne contamination) in the Building 771 ventilation system were deliberately damaged by workers and had to be replaced. The Board's evaluation of this event found that the report filed by RFETS in the DOE Occurrence Reporting and Processing System was inaccurate and did not acknowledge that the filter damage was caused by vandalism. The Board further determined that neither the manager of DOE's Rocky Flats Field Office nor appropriate personnel within DOE Headquarters were aware of the vandalism. A corrected occurrence report was issued after the Board notified DOE Headquarters of the situation.

3.4.7 Savannah River Site

DOE issued a major contract modification for work at SRS in June 2003, effective through 2006. The contract modification incorporates an accelerated cleanup and decommissioning schedule with performance incentives for meeting goals. Several incidents have occurred during recent decommissioning work: (1) a worker in Building 247-F was struck by a falling pipe when it was cut for removal; (2) workers removing electrical lines in Building 247-F cut into energized electrical lines; and (3) two workers in Building 221-F were spattered with radioactive liquid when drilling a hole in a processing line. The Board has reviewed each of these incidents and has examined DOE's oversight of D&D activities at SRS. In the future, the Board plans to follow closely the work of a new DOE unit at SRS devoted to oversight of D&D activities.

3.4.8 Lawrence Livermore National Laboratory

In January 2003, the Board reviewed preparations for deactivation of Building 251 at LLNL. LLNL plans to empty Building 251 of heavy elements and decontaminate and dismantle its glovebox and enclosure systems. Encapsulation and removal of plutonium-beryllium neutron sources from the underground storage vaults in Building 251 have been completed. This task was considered a pilot project for removal of other items. Based on the plutonium-beryllium experience, it appears that significant additional preparations must be made before the facility will be ready to begin removal of additional items from the vaults.

4. NUCLEAR FACILITIES DESIGN AND INFRASTRUCTURE

4.1 NUCLEAR FACILITY DESIGN REVIEWS

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 ISM 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 ISM principles and core functions, and development of ISM-based manuals of practice to be followed throughout design and construction.

4.1.1 Plutonium Storage at Savannah River Site

DOE is planning to consolidate its excess plutonium at SRS pending final disposition. Some of the material will be used as feed to manufacture mixed-oxide reactor fuel. Disposition is still being determined for the remaining material. DOE is considering immobilizing the plutonium in glass and shipping the glass logs to the planned Yucca Mountain repository. Neither of these disposition paths will be completed in the next 10 years.

Whatever options are chosen, it is clear that plutonium will be stored at SRS for many years. As requested by Congress, the Board evaluated the SRS facilities planned to be used for this storage. In the mid-1990s, DOE had planned to store the excess plutonium in a new facility specifically designed for storage. This facility had been designed and excavation begun when DOE canceled its construction in 2001. This decision was based primarily on budget constraints and expectations that the plutonium would be disposed of in a short period of time. DOE's plans have now shifted to utilizing several 50-year-old facilities at SRS that do not meet modern safety standards. The two main facilities planned for storage are the old K-Reactor facility in which several areas have been modified for storage, and Building 235-F. The plutonium storage facility is now called the K-Area Material Storage (KAMS) facility.

The Board's study concluded that storage of plutonium in KAMS could be safely accomplished for the next 4 or 5 years, but that for extended storage beyond this time, improvements in fire protection should be undertaken. The Board's study further concluded that DOE should carry out its plan to remove plutonium currently in 235-F and should not plan on extended storage of plutonium in this facility without substantial modernization of the safety systems and confirmation of the building's structural adequacy.

The Board issued its report to Congress and DOE on December 1, 2003. In the Board's view, construction of a modern plutonium storage facility might prove to be both cost-effective and safety-conscious.

4.1.2 Hanford Waste Treatment Plant

The Board continues to review development of the design and safety basis for the WTP at Hanford. The Board's oversight was directed into two major areas in 2003: adequacy of the

structural design and construction effort, and technical adequacy and basis for safety-related controls.

Structural Design. The structural design review continued to focus on the adequacy of the High-Level Waste (HLW) building, a very large, complex structure. In light of this complexity, the Board requested that DOE prepare a summary structural report for this building (and for other WTP facilities). DOE has made significant progress towards completing this report. Results so far suggest that those portions of the HLW building already constructed are structurally sound.

Concrete Placement. The Board's construction review has concentrated on the problems encountered by the contractor in placing structural concrete. Concrete placed in December 2002 in the foundation of the HLW facility developed surface cracks without an obvious cause. The contractor prematurely declared the pour acceptable without any clear understanding of the potential detrimental effects to the structure. The Board's concern with the rigor of the evaluation prompted the contractor to conduct a more thorough evaluation. The results confirmed the structural integrity of the foundation and provided the contractor the basis to improve work procedures to prevent recurrence.

Another concrete placement problem occurred in July 2003, when concrete placed during the month showed a general decrease in strength, calling into question the adequacy of thousands of cubic yards of concrete already placed. Unlike previous problems, this event was vigorously evaluated by the contractor to determine the cause and find corrective actions. The evaluation demonstrated that the weak concrete would likely gain the necessary strength as it continued to cure, and it also showed the need to improve the process for controlling raw material input more closely.

Safety Basis and Hydrogen Gas Issue. In a 2002 letter to DOE, the Board pointed out a number of flaws in DOE's development of the WTP safety basis and requested a report describing how these deficiencies would be corrected. Responding in 2003, DOE proposed solutions to substandard calculation quality, systematic weaknesses in the evaluation of hazards, and the lack of a suitable technical basis for controlling the generation of hydrogen gas. The Board reviewed and found these proposals acceptable.

With respect to the hydrogen problem, DOE has recently completed development of a hydrogen generation rate model that effectively bounds how much of this flammable gas will be generated within the WTP. To lend experimental support to the model, the Board suggested and DOE has performed tests to understand how hydrogen gas is retained and released from WTP wastes under a variety of anticipated plant conditions. These tests allow DOE to adequately design the air dilution systems needed to prevent hydrogen gas accumulation.

Electrical Safety. The Board completed a review of the WTP electrical system and identified problems with cable degradation that would be caused by radiation exposure. DOE agreed and decided to test electrical cables to establish defensible cable lifetime estimates. These estimates will be used to draft cable replacement plans.

Requirements and Standards. In a letter dated May 29, 2003, the Board challenged proposed changes to the WTP Safety Requirements Document. These changes permitted the contractor to alter required codes and standards and to make significant design changes, both without prior DOE review. DOE responded by retaining control over such changes.

4.1.3 Highly Enriched Uranium Materials Facility

The Board identified deficiencies in the foundation design and confinement ventilation system in the HEUMF located at Y-12. The previous foundation design relied on a fill material that would have caused unacceptable forces in the structure during a seismic event. In response, DOE adopted a design that employs concrete fill; this approach has been analyzed and found to produce acceptable building responses. This change in foundation design will significantly reduce the risk of damage due to an earthquake and will promote long-term stability of the structure.

The Board also questioned the lack of a filtered confinement ventilation system in the original design. DOE modified the design to include a safety-grade, filtered confinement system that will provide a required level of protection.

4.1.4 Savannah River Site: Pit Disassembly and Conversion Facility

For several years, the Board has been reviewing the design for the Pit Disassembly and Conversion Facility (PDCF). While the main structure of PDCF's Plutonium Processing Building was designed to survive the design basis earthquake, this is not the case for many of the 2-hour fire barriers between fire zones. As a result, a seismically-induced, full-facility fire could lead to an offsite dose exceeding the evaluation guideline. The Board issued a letter on May 13, 2003, urging DOE to consider upgrading the design of the fire barriers to withstand the design basis earthquake, thus eliminating the potential for a full-facility fire. The contractor has prepared a Fire Risk Analysis that concludes a seismically-induced, full-facility fire is not a credible scenario. The Board is reviewing the analysis to determine whether it agrees with the contractor's conclusions.

4.1.5 Los Alamos National Laboratory: TA-18 Safety Class Control Design

In a letter dated July 19, 2003, the Board objected to LANL's failure to follow DOE requirements for new safety-class equipment in the Technical Area (TA)-18 facility. While the Board's primary concern was that single credible failures would prevent the required safety actions, the Board also questioned the technical feasibility of the DOE-directed approach—monitoring the temperature of the nuclear material—to preventing the accident. Adding to these concerns was a lack of independent review of the design. As a result of the Board's objections, DOE performed a review of the completed design package for one of the TA-18 safety class controls. Initial indications are that some of the problems have still not been adequately resolved.

4.1.6 Pantex Building 12-64: Roof Design Weaknesses

In a letter dated June 25, 1998, the Board questioned the use of Pantex Building 12-64 for nuclear explosive operations, primarily because of significant cracking on the underside of the bay roofs caused by a deficiency in the original design. As a consequence, DOE terminated nuclear explosive operations in this building but also decided to upgrade the building as needed to resume nuclear explosive operations. The Board, in a letter dated October 10, 2003, stated that the proposed upgrades do not fully correct structural deficiencies. DOE is now developing a plan to correct roof deficiencies for both seismic loads and internal explosions.

4.1.7 High Efficiency Particulate Air Filter Testing and Infrastructure

The Board identified many weaknesses in DOE's program for the use of High Efficiency Particulate Air (HEPA) filters in safety applications. In response to the Board's January 9, 2003, letter, DOE confirmed its original commitments to maintain the Filter Test Facility, send certain classes of HEPA filters through this facility, assess the results of filter testing, and perform self-assessments of HEPA test programs.

4.1.8 Dynamic Experiments at Los Alamos National Laboratory

For the past several years, the Board has reviewed design and development work on the Dynamic Experiments (DynEx) Project. Among the Board's findings have been the need to strengthen the vessel design requirements and procurement specifications and to identify safety-class or safety-significant systems and equipment early in design. In a letter dated May 12, 2003, the Board noted that LANL had made major changes in its approach to this project in line with the Board's observations, resulting in significant safety improvements.

4.1.9 Tritium Extraction Facility at Savannah River Site

The Tritium Extraction Facility (TEF) will be used to extract tritium from target rods irradiated in commercial light water reactors. The extracted tritium is to be used to replenish tritium reserves for the nation's nuclear weapons stockpile. During the past 6 years, the Board conducted extensive reviews and provided comments to DOE. The Board has continually stressed the application of ISM to the design process to ensure that hazards were identified and appropriate controls developed. The Board has concluded that the TEF design provides adequate controls to address the potential hazards posed. The completed facility should be capable of operating in a manner that provides adequate protection of the workers, the public and the environment, provided it is constructed in accordance with the design requirements.

During 2003, the Board reviewed building construction and safety-related component fabrication for conformance to design requirements. The Board found that the contractor had procedures in place to ensure design requirements would be met. Confirmation that the procedures were being correctly implemented was obtained by reviewing selected building construction features and components down to the level of inspection reports. Based on these reviews, the Board concluded that the TEF is being constructed in accordance with the specified design requirements.

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 conduct adequate oversight of contractors working on defense nuclear facilities. In this context, oversight 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.

DOE is engaged in making major changes in its approach to safety oversight of defense nuclear facilities. DOE is currently implementing, or is planning, three simultaneous initiatives that affect its safety oversight of defense nuclear facilities. The sum and substance of this initiative is to place principal reliance on the contractor to ensure that work is done safely, move from prescriptive requirements to performance criteria, and decrease reliance on federal safety oversight of contractor operations. In the midst of this, information developed by the Columbia Accident Investigation Board with respect to the loss of the space shuttle, and by the U. S. 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. In furtherance of its statutory duty to protect the public health and safety from hazards at defense nuclear facilities and its charge to restore confidence in DOE's management capabilities, the Board conducted six public meetings between September and December 2003. The meetings, which will continue in 2004, are intended to provide a record on which to assess DOE's proposals for changing its oversight, contract management, and directives systems.

5.1.2 Public Meetings

During its public meetings, the Board heard testimony from representatives of the U.S. Nuclear Regulatory Commission, the Naval Reactors Program, the Columbia Accident Investigation Board, the Deputy Secretary of Energy, the Administrator of NNSA, the Undersecretary for Energy, Science and Environment, selected DOE and NNSA Site Managers, and senior contractor managers from SRS, RFETS, Hanford, Pantex, Y-12, LANL, and LLNL. The Board explored proposed oversight policies, contract reform initiatives, and contractor self-assessment programs. Because the Board had observed that some DOE or NNSA sites had exerted rigorous federal oversight, while others had relaxed the level of oversight by varying degrees, testimony was elicited on what these organizations had learned with regard to safety performance.

5.1.3 Informational Seminars

In addition to the public meetings, the Board invited social science experts to present in-house seminars on the causal relationships between organizational behavior and operation of high risk activities. The experts included Dr. Sonya Haber (key member in the FirstEnergy Nuclear Operating Company's investigation of the Davis-Besse nuclear power plant incident); Dr. Scott Sagan (Professor at Stanford University and author of *Limits of Safety*); Mr. James Chiles (author of *Inviting Disasters*); Dr. Charles Perrow (Professor Emeritus at Yale University and author of *Normal Accidents*); and Dr. Todd LaPorte (Professor at University of California–Berkeley and author of numerous papers on highly reliable organizations).

The Board gleaned from these seminars that a key attribute of successful organizations is an independent, technically competent engineering staff that centrally controls technical safety specifications and waivers. This attribute was stressed in the Columbia Accident Investigation Board's report and highlighted in the testimony from the Naval Reactors program. Another characteristic of success is redundancy in systems—whether engineered or human—to improve overall system reliability. The Columbia Accident Investigation Board identified reductions in institutional redundancy at the National Aeronautics and Space Administration as one of the organizational contributors to the Columbia shuttle accident.

5.1.4 DOE and NNSA Initiatives

Overview. DOE and NNSA are revising their oversight model and asserting that the proposed changes will allow the government to obtain work more efficiently without a loss of safety, and with a concomitant reduction in government costs and accelerated completion of projects. These improvements would be welcome. However, the Board is concerned that these changes may trade safety for efficiency. Admittedly it is difficult to define acceptance criteria in advance for these new oversight methods. The best measure of any oversight model is long-term performance, suggesting the advisability of gradual change to evaluate the effects and change course as needed. But because DOE and NNSA are making rapid changes in organizational structure and staffing, altering course later may become difficult or impossible.

DOE's reliance on generating and gathering performance data using information technology is also cause for concern. The performance metrics in use or planned by DOE may or may not give adequate warning of incipient safety problems.

Reduction of Headquarters Staff. The Board has observed that DOE and NNSA are reducing if not entirely eliminating headquarters technical staff assigned to support oversight by line management. Such reductions may deprive senior DOE line managers of technically competent assistance. Over-reliance on a common data source (that is, field-level assessments) may lead to common-mode failure at upper levels of the organization. This problem is compounded if field elements lack skilled and technically trained personnel to perform oversight work.

Directives System. DOE is also modifying its directives system in an attempt to emphasize "what" is to be accomplished but not necessarily "how" it is to be accomplished. This approach is intended to provide contractors with the flexibility to streamline approaches to

their work, resulting in improved efficiency. While this tactic has potential advantages, relaxing centrally-controlled, prescriptive safety requirements derived from 60 years of nuclear operations experience is a perilous step to take.

Contracts. DOE and NNSA are altering the terms of many contracts to reward the achievement of ultimate outcomes or results rather than intermediate milestones. NNSA contracts increasingly specify required end-states, products, or conditions, but are becoming less prescriptive about required methods to achieve those outcomes. This approach could result in unintended consequences if it invites taking greater risks to obtain promised contractual benefits.

5.1.5 Conclusion

The ability to spot negative trends and incipient safety problems should not be the only measure of an adequate safety oversight system. A complete, trustworthy, and technically competent system of safety oversight should be used to find the root causes of problems, identify effective corrective actions, verify that the actions are taken, and to establish a rational set of safety requirements. The Board will continue to evaluate all the information it has collected from its public meetings and seminars and will be deciding upon a course of action in 2004.

5.2 INTEGRATED SAFETY MANAGEMENT

5.2.1 Overview

ISM is a concept that evolved from Recommendation 95-2. The basic tenets of ISM provide the framework for safely performing all of the diverse hazardous activities in the defense nuclear complex. ISM provides for a single safety management program rather than multiple, unintegrated programs. Nuclear safety is an important but not exclusive target of ISM. Nonradioactive hazardous materials and operations require attention in proportion to the risks they pose to the public, workers, and the environment. ISM builds upon standards of safe practice for nuclear, chemical, and other hazardous operations to ensure protection of the public, workers, and the environment.

Since the Board's issuance of Recommendation 95-2, the implementation of ISM has progressed through three phases: (1) developing necessary guidance documents; (2) establishing the infrastructure for implementing ISM at individual sites and facilities, and (3) confirming that ISM systems are effective and are being applied to design and construction, start-up, operation, and decommissioning of DOE's hazardous facilities. At the end of 1999, the implementation of ISM was well into the second phase. With the successful completion of ISM System Verification Reviews at all sites during 2000, the Board's focus on implementation of ISM shifted to the third phase. Throughout 2003, the Board stressed the need to look beyond initial implementation to ensure continued improvement. In addition to ensuring that ISM was implemented at all DOE sites, the Board focused on three key initiatives that are critical to the long-term effectiveness of ISM: the annual update process, completion of Recommendation 2000-2 tasks, and activity-level implementation.

5.2.2 ISM Annual Update Process

In 2003, the Board continued to oversee the implementation and effectiveness of ISM at defense nuclear facilities. The Board evaluated the efforts of the Energy Facility Contractors Group to improve ISM and the updated ISM descriptions for several sites.

In an October 2001 letter to DOE's Office of Environmental Management, the Board had noted the failure to correct numerous deficiencies in the operations of the Bechtel Jacobs Company and its subcontractors at ORNL. The long-standing failure to apply nuclear safety requirements in those operations indicated that the ISM systems for the Oak Ridge Office and for the Bechtel-Jacobs Company were not functioning, most especially in the area of feedback and improvement. In response to the Board's letter, DOE corrected the deficiencies and verified the adequacy of the ISM systems at ORNL. The Board noted a major positive shift in ISM implementation by the Bechtel-Jacobs Company and DOE's Oak Ridge Office.

5.2.3 Reliability and Configuration Management of Vital Safety Systems

Defense nuclear facilities typically incorporate safety systems designed to control the hazards that are present. Conditions specifying operational limits for these systems placed into Authorization Agreements between DOE and its contractors. For the many facilities constructed decades ago, it is essential that emphasis be placed on the maintenance and continued reliability of vital safety systems.

In Recommendation 2000-2, the Board urged DOE to ensure the operability of vital safety systems by (1) assessing their reliability and operability; (2) requiring that contractor personnel responsible for configuration management maintain the design basis and operating limits; (3) confirming that DOE's technical staff has the requisite number of qualified subject matter experts; and (4) inserting necessary legal requirements into DOE directives and contracts.

In response to the Board's actions, DOE has taken steps to ensure the operability of vital safety systems. During 2003, DOE actions in this regard included in-depth reviews of specific systems and programs (such as control of drawings and configuration management) known to be problem-ridden. These reviews uncovered weaknesses in the operability of several systems, leading to further evaluation and sometimes to repairs. DOE is now evaluating these deficiencies and formulating corrective actions.

At the Board's urging, DOE has also staffed the federal oversight positions for key safety systems and is developing suitable qualification and training programs. In addition, DOE has issued a major revision to the handbook on ventilation design. Overall, the Board noted that a number of important improvements have been made in ensuring that vital safety systems remain fully operable.

5.2.4 Activity Level Work Planning

The Board has been emphasizing 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 use appropriate feedback mechanisms to ensure continuous improvement

at the individual activity level. The concept of ISM is particularly well suited to ensuring safety at the activity level. In 2003, the Board focused attention on the implementation of ISM at the activity level by conducting a number of site-specific safety reviews. Significant deficiencies were revealed in the methods being used to implement ISM at Pantex, LLNL, and LANL. The Board will provide oversight to DOE and NNSA as they define and implement corrective actions.

5.3 HEALTH AND SAFETY DIRECTIVES

5.3.1 Improvement of Directives

During 2003, the Board received 68 new or revised drafts of health and safety directives and NNSA policy letters from DOE for review. Highlights of the Board's reviews follow:

- **Nuclear Air Cleaning Handbook**. In response to Recommendation 2000-2, DOE committed to publishing a revised *Nuclear Air Cleaning Handbook* (DOE-HDBK-1169-2003) by December 2002. The Board provided extensive commentary to improve the overall quality of the handbook. Resolution of comments forced DOE to extend the publication date; the handbook was eventually published in December 2003**.**

- **Worker Protection Management.** The Board scrutinized the revision of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*. This effort was completed in June 2003, culminating in an updated directive that included important new biological agent protection requirements developed in response to increased homeland security awareness.

- **Electrical Safety Handbook**. In June 2001, the Board had urged DOE to take a leadership role with respect to electrical safety. DOE agreed to update the *Electrical Safety Handbook* in August 2002. However, in July 2003 the Board learned that DOE had deleted much of the technical content in the proposed revision. The Board informed DOE that this was unacceptable, especially in light of the high rate of electrical safety incidents observed across the defense nuclear complex. DOE is now revising the handbook.

- **Environment, Safety, and Health Reporting.** During 2003, the Board provided technical advice on DOE's effort to consolidate and revise various reporting orders into a single directive. The Board commented on draft DOE Order 231.1A, *Environment, Safety and Health Reporting* and its many supporting documents. These revisions, which are key to maintaining a strong feedback and improvement program across the defense nuclear complex, are now being implemented. The Board will monitor closely the effectiveness of the revised program during this implementation phase.

- **NNSA Policy Letters.** NNSA instituted in 2003 an internal system of directives under the authority of its organic statute, Public Law 106-65. The Board's review of this system, however, found that it had not been adequately described, new directives

were being issued in potential conflict with existing directives, and all of the conditions of the Public Law had not been satisfied. The Board has provided expert oversight of NNSA's effort to design a system that would meet the needs of NNSA without adversely affecting safety.

- **Assignment of Functions, Responsibilities, and Authorities.** The Board's comments on a proposed revision to DOE Manual 411.1-1, *Safety Management Functions, Responsibilities, and Authorities Manual*, helped clarify the role of DOE's safety oversight offices. At the end of 2003, DOE issued the revised Manual. Sub-tier documents prepared in the interim by NNSA and by DOE's Office of Environment, Safety, and Health were also reviewed and commented upon by the Board before issuance.

- **Functional Area Qualification Standards.** During 2003, the Board reviewed and provided extensive comments on 16 new or revised Functional Area Qualification Standards. With continuing oversight by the Board, DOE's Federal Technical Capabilities Panel is upgrading the knowledge, skills, and abilities of DOE technical personnel.

5.3.2 Worker Safety Rulemaking

On December 8, 2003, DOE provided notification of a proposed rule on worker protection, 10 CFR Part 851, *Worker Safety and Health*. This action was required under the Bob Stump National Defense Authorization Act, Public Law 107-314, which directed DOE to promulgate regulations on worker safety and health, rather than rely exclusively on a contractual approach. The Board is conducting a detailed review of the proposed rule. Of immediate concern is that DOE intends to cancel DOE Order 440.1A, *Worker Protection Management for D0E Federal and Contractor Employees*. Currently, this order and its associated manuals and guidance documents provide specific safety requirements for several areas of interest to the Board: explosives safety, pressure vessel safety, and suspect and counterfeit parts. They also serve as implementing directives for Integrated Safety Management at the activity level. Many requirements and guidance, painstakingly developed during 50 years of experience across the complex, may be lost unless these requirements and guidance are formally implemented in a new set of directives to be issued concurrently with the new rule. During 2004, the Board will be heavily involved in DOE's efforts to satisfy Public Law 107-314 in a manner that provides optimal protection of worker health and safety.

5.3.3 Implementation of Directives

A directive can only contribute to health and safety if it is rigorously and competently carried out in the field. In 2003, the Board continued to closely scrutinize the implementation of health and safety directives at defense nuclear facilities. Examples of the Board's work in this area include:

- **Systematic Review of Orders.** In 2001, DOE initiated an internal review to determine whether the requirements in DOE orders were consistent with its current intent to focus on performance objectives. Teams were formed to review the orders

and provide their findings and recommendations to a panel of senior DOE managers. The panel reviewed the teams' reports and forwarded recommendations to Program Secretarial Officers. The Board reviewed the proposed changes and identified two safety concerns: the proposed relaxing of requirements for accident investigations, and a scheme to reduce the applicability of DOE to defense nuclear facility contracts.

- **Unreviewed Safety Question Procedures.** The Unreviewed Safety Question (USQ) process required by 10 CFR 830.203 is the mechanism for ensuring that the safety basis for a defense nuclear facility is not invalidated by undocumented or unauthorized changes. In 2003, the Board reviewed seven USQ procedures and identified substantial areas of noncompliance with the governing requirements. Responding to these findings, DOE required substantial revisions and demanded that contractors submit for approval changes to documents that previously could have been changed without DOE approval.

- **Integration of Hazard Analyses.** The Board's review of this topic found less-than-adequate implementation of safety requirements caused by inconsistencies and lack of integration of directives. In particular, the use of inconsistent methodologies in the hazards analyses for such applications as emergency management, facility safety design, and documented safety analyses resulted in conflicting safety data. As a direct result of the Board's activities, DOE issued a handbook entitled *Integration of Multiple Hazard Analysis Requirements and Activities* (DOE-HDBK-1163-2003). Using this handbook, several DOE contractors have performed their activities in a safer, more integrated, and significantly more cost-effective manner.

5.4 SAFETY PROGRAMS

5.4.1 Development and Implementation of Safety Controls

The development of a comprehensive safety basis and the identification and selection of an appropriate control set are cornerstones of safe operation at defense nuclear facilities. The Board conducted numerous reviews of safety bases throughout the DOE complex in 2003. The Board reviewed the critical assumptions made and the control strategies relied upon to prevent and mitigate accidents.

The Board identified a number of specific instances where unjustified assumptions and methodologies were used in the development of safety bases. For example, some analyses did not consistently use bounding input assumptions and implicitly credited non-qualified plant equipment. These deficiencies led to safety analyses that may not have bounded the actual hazard conditions for the facilities concerned. In a letter to NNSA dated April 10, 2003, the Board documented weaknesses in the documented safety analysis for the plutonium facility at LLNL. As a result of this letter, DOE took corrective actions.

Contractors at nuclear facilities were required by 10 CFR Part 830 to submit to DOE safety analyses and controls by April 2003. Many contractors had to develop new analyses and, perhaps more importantly, new safety controls. In many cases, the choice of these new safety controls was limited because the equipment had been built years or even decades ago. As a

result, DOE chose to reclassify existing equipment as safety-related and, in a departure from past practice, opted to rely also on safety-related administrative controls rather than engineered features.

Recommendation 2002-3 identified the need for DOE to improve its guidance and expectations on the use of administrative controls at defense nuclear facilities. As a result of the Recommendation, DOE developed a plan to improve the reliability and effectiveness of administrative controls that serve safety functions. The Board accepted DOE's Implementation Plan in July 2003. In letters dated August 25, 2003, and December 8, 2003, the Board agreed that DOE had completed some of the commitments in this Plan.

5.4.2 Quality Assurance

During 2003, the Board continued to seek improvements in DOE's Quality Assurance (QA) Programs. In previous years, the Board had found weaknesses in DOE's implementation of existing QA requirements for safety-related components and systems, as well as weaknesses in requirements and guidance on engineering practices for safety-related software. DOE completed several commitments in its *Quality Assurance Improvement Plan* to strengthen the implementation of quality assurance in the design, procurement, construction, operation, and maintenance of vital safety systems. To date, these actions have not been fully effective in achieving the required quality objectives.

5.4.3 Software Quality Assurance

Overview. The design and operation of many of DOE's defense nuclear facilities relies on analysis and operational support by computer codes. During the past few years, the Board has identified problems caused by inadequate software design, implementation, testing, configuration management, and training. These problems could lead DOE to rely on erroneous information affecting safety. For this reason, in late 2002 the Board issued Recommendation 2002-1, proposing significant changes to DOE's policies and practices for software quality assurance (SQA). These changes included clearly assigning responsibilities and authorities for SQA, issuing revised directives for software development and use, and recommending software packages for use in safety system analysis and design.

Following the incorporation of extensive comments and final approval from the Board, DOE issued on March 13, 2003, its plan to improve SQA at defense nuclear facilities. Initial DOE efforts to complete the commitments were ineffective. However, DOE made improvements following the completion of the commitment to establish an Office of Quality Assurance reporting to the Assistant Secretary for Environment, Safety and Health. Since that time, DOE has completed several other commitments, including: developing SQA criteria for commonly used software analysis codes; publishing guidance reports for users of six software analysis tools; selecting the industry SQA standards that will be invoked by DOE directives; developing a qualification standard for DOE personnel involved with the oversight of contractor SQA practices; and developing the criteria that will be used to assess existing safety-related software. The majority of the DOE efforts associated with this Recommendation remain to be completed.

Site-Specific Reviews. During 2003, the Board assessed SQA at SRS (Tritium Extraction Facility), Pantex (movement of high explosives and nuclear material between facilities), Hanford (Waste Treatment Plant), and LANL (criticality control systems). The Board's oversight of Pantex is illustrative of this year's accomplishments.

In a letter dated March 25, 2003, the Board questioned the quality of two computer software products developed to improve Pantex operations. The Move Right System, activated in January 2003, controls and tracks the movement and storage of nuclear explosives, high explosives, and radioactive material. The Board noted deficiencies in the associated software engineering products, as well as a lack of rigor in DOE's testing of the system. Another product, Interactive Electronic Procedures, will be used by technicians to disassemble, assemble, and maintain nuclear weapons. The product will also be used by the engineers and scientists at the supporting national laboratories to develop, review, and approve the procedures used by the technicians. The Board learned that although system level testing of the Interactive Electronic Procedures was scheduled to begin a few weeks after the Board's review, key elements of the software, such as the requirements specifications, were still in draft form, and the test procedures had not yet been written.

As a result of the review conducted by the Board, the Pantex contractor improved the procedures associated with SQA. The contractor formed an SQA Section within the Information Technology Department and staffed it with experienced personnel. The Move Right System software was revised and upgraded to correct known problems and meet more stringent quality requirements. Software and documentation practices for the Interactive Electronic Procedures were similarly upgraded. Other plant software was tested and enhanced test procedures were designed for future use.

5.4.4 Suspect and Counterfeit Parts

In June 2002, Department of Defense investigators notified DOE that a vendor of heat treating services supplied potentially improperly heat-treated aluminum to firms that supplied parts to DOE. Notwithstanding repeated assurances from DOE's Quality Assurance Working Group that reviews would be conducted to detect nonconforming heat-treated aluminum, DOE failed to adequately assess whether such parts were installed until the Board brought the matter to the direct attention of the Secretary of Energy. The Board also observed that DOE had repeated several of the missteps that occurred in response to similar quality issues affecting semiconductor devices in previous years. As a result of the Board's efforts, DOE has fundamentally restructured its quality assurance programs.

The Board continues to provide oversight and technical assistance to DOE in order to identify and prevent the introduction of suspect and counterfeit parts into safety-related or mission sensitive applications affecting defense nuclear facilities. The Board's oversight and timely intervention in dealing with suspect and counterfeit parts has been pivotal in energizing the establishment of DOE quality assurance programs.

5.4.5 Hoisting and Rigging

The proper planning and conduct of lifting tasks is an important element of nuclear operations safety at defense nuclear facilities. In 2003, the Board reviewed the safety of hoisting and rigging activities at Pantex, SRS, and NTS. In a letter dated July 10, 2003, the Board provided to DOE an assessment of the hoisting and rigging program at Pantex, and some general observations pertaining to all sites. The Board identified a number of weaknesses in equipment design, reliability, maintenance, and training. As a result of the Board's review, DOE made substantial safety improvements in this program.

5.4.6 Criticality Safety

Throughout 2003, the Board conducted a comprehensive review of the results obtained from DOE's implementation of Recommendation 97-2. The Board was able to conclude that criticality safety had improved across the complex and closed the Recommendation in August 2003. To maintain these gains, however, the Board has stressed the need for aggressive self-assessment programs and expanded use of operational facility reviews and independent oversight. In closing the Recommendation, the Board requested an annual report from DOE on funding for this program.

Criticality control principles must be incorporated into the design of new facilities at an early stage. For this reason, the Board has had under continuous review the design of criticality controls at PDCF. This design employs a unique safety control system involving numerous measurements of weight and radiation signatures throughout the process. To assess the wisdom of this approach, the Board urged DOE to take advantage of the expertise available in DOE's Nuclear Criticality Safety Support Group, composed of senior criticality specialists. Their review highlighted significant potential issues with the development and operation of similar critical mass control systems.

To highlight the Board's interest in criticality safety, a member of the Board provided the keynote presentation on this topic at the 2003 joint winter meeting of the American Nuclear Society and the European Nuclear Society.

5.4.7 Research and Development Safety

As a result of a series of incidents in the past two years, the Board has begun to review the research and development work practices of the major DOE defense nuclear contractors. The most serious near-miss accidents occurred at LANL in 2002 and at Y-12 in April 2003. The Y-12 incident involved an explosion and glovebox fire at the Development Division's Saltless Direct Oxide Reduction pilot plant. The Board reviewed the Division's revised work practices and corrective actions, including new requirements for process hazard analyses, design reviews, and formal start-up procedures.

5.5 TECHNICAL COMPETENCE

5.5.1 Training and Qualification of DOE and Contractor Personnel

During 2003, the Board continued to monitor the competence of key health and safety personnel at defense nuclear facilities. Early in the year, the Board reviewed actions being taken at Pantex to improve procedural adherence, conduct of operations, and training. The Board found that site instructions and supporting records did not ensure accomplishment of training objectives as set forth in DOE Order 5480.20A.[11] In an April 2003 letter to NNSA, the Board observed that these training deficiencies may affect the contractor's ability to maintain and improve conduct of operations. On July 9, 2003, the Board requested that NNSA describe the scope and periodicity of the training assessments conducted as required by DOE Order 5480.20A for all NNSA site offices, including Pantex, and determine whether the required assessments are being performed. NNSA initiated a review at all field sites and in an October 2003 letter to the Board, reported that three sites in addition to Pantex were not in compliance with the scope and periodicity of the reviews required by the Order. NNSA committed to conducting the required reviews by the end of June 2004.

5.5.2 System Engineers and Federal Subject Matter Experts

In Recommendation 2000-2, the Board urged DOE to develop requirements for training and qualification of subject matter experts in vital safety systems ("system engineers") for both federal and contractor organizations. From July 2002 to March 2003, the Board evaluated DOE's efforts to institutionalize the use of system engineers and federal subject matter experts for vital safety systems. The Board conducted reviews at five sites Y-12, Pantex, LLNL, the Office of River Protection, and the Richland Operations Office.

Although it appeared that, for the sites visited, the managers of the DOE site offices and the site contractors supported Recommendation 2000-2 and were working to implement its principles, there was a wide disparity in effectiveness. Specific problems identified included lack of full staffing of federal and contractor slots for subject matter experts and systems engineers, and failure to complete work on functional area qualification standards. DOE is now attempting to fill these vital technical positions, but in the Board's view more senior management attention and resources are needed for this effort. The functional area qualification standards were nearing completion by the end of 2003.

5.5.3 Nuclear Weapons Knowledge

DOE needs to retain a cadre of professionals having deep understanding of nuclear weapons assembly and disassembly. The needed expertise is not available outside of the defense laboratories and is only developed through experience in nuclear operations. Encouraging the brightest minds to devote a portion of their time to developing weapons expertise remains a challenge and was the focus of Recommendation 2002-2. In 2003, the Board approved DOE's Implementation Plan for this Recommendation.

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[11] *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities* (2001).

6. PUBLIC OUTREACH

The Board keeps the public informed of its work through public meetings, quick responses to public requests for documents, effective responses to public inquires into health and safety issues, outreach activities of the Board's site representatives, and an Internet website.

6.1 PUBLIC MEETINGS

During 2003, the Board conducted six public meetings in Washington, D.C., regarding DOE oversight policy. (See Section 5.1.2 above for further information.)

6.2 RESPONDING TO PUBLIC REQUESTS

The Board answered numerous public requests for documents and information during 2003. The Board also responded to 21 requests filed under the Freedom of Information Act. The average response time was 3.5 working days, as compared with the statutory requirement of 20 working days. The Board has posted on its website a complete list of requests processed since 2000.

6.3 ELECTRONIC ACCESS

The Board posts all essential, publicly-releasable documents on its website (www.dnfsb.gov) in a timely manner. All documents are downloadable in PDF format. 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. There were five such mailings in 2003. An initiative was begun in late 2003 to offer those on the Board's mailing list the option of receiving documents via e-mail in lieu of paper copies. This would serve to speed distribution of these documents, provide significant savings in printing and postal costs and would further the Board's E-Government initiative.

The Board continues to evaluate the effectiveness of its information security program to ensure that it is in compliance with the requirements of the Federal Information Security Management Act and other related standards and guidance. During 2003, the Board's information technology (IT) security staff upgraded computer security by measures such as strengthening the Board's internet firewall to prevent intrusion. The Board will commission another independent evaluation of its information security program during 2004 to ensure that past improvements have been successfully implemented and to detect any additional weaknesses.

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 staff 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 2003, the Board directed inquiries into health and safety issues at DOE Headquarters, RFETS, Hanford, Fernald, SRS, and LANL. The DOE-Headquarters review resulted in a complete restructuring of DOE programs and responsibilities established to prevent the introduction of suspect and counterfeit items into safety or mission-sensitive applications. The Board identified fundamental breakdowns in DOE's suspect and counterfeit parts programs and shortcomings in DOE's response to a Department of Defense notification of a suspect and counterfeit parts alert. Suspect and counterfeit parts continue to be supplied to DOE, and constant attention is required to prevent installation. Where such parts have already been installed, they must be identified and removed without delay. The RFETS inquiry identified systemic failures in contractor and DOE oversight activities leading up to and subsequent to a fire in a plutonium-contaminated glove box. As a result, the Board communicated to DOE a comprehensive list of health and safety issues which are now being addressed by DOE.

6.5 SITE REPRESENTATIVE ACTIVITIES

The Board enhances its on-site health and safety oversight of defense nuclear facilities by assigning experienced technical staff members to full-time duty at priority DOE sites: Pantex, Hanford, SRS, Y-12, and LANL. 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.

APPENDIX A
Recommendations Cited

Number	Date	Title
94-1	May 26, 1994	Improved Schedule for Remediation in the Defense Nuclear Facilities Complex
95-2	October 11, 1995	Safety Management
97-1	March 3, 1997	Safe Storage of Uranium-233
97-2	May 19, 1997	Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy
98-2	September 30, 1998	Safety Management at the Pantex Plant
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
2001-1	March 23, 2001	High-Level Waste Management at the Savannah River Site
2002-1	September 23, 2002	Quality Assurance for Safety-Related Software
2002-2	October 3, 2002	Weapons Laboratory Support of the Defense Nuclear Complex
2002-3	December 11, 2002	Requirements for the Design, Implementation, and Maintenance of Administrative Controls

APPENDIX B
2003 Reporting Requirements

Date of Letter	Subject	Response Required	Response Due
December 8	NNSA roles and responsibilities plan	With FRA Manual	With FRA Manual
December 2	Glovebox fire at RFETS	Action Plan	60 days
November 7	Transuranic waste retrieval at Hanford	Letter	90 days
August 19	Electrical and lightning protection at LANL	Letter	30 days
August 7	Electrical safety handbook	Letter	30 days
August 7	Improving operational safety at Fernald	Briefing	90 days
August 7	Criticality Safety Program/closing Rec. 97-2	Report	6 months
July 31	Combustibles at RFETS	Report	15 days
July 10	Hoisting and rigging operations at Pantex	Briefing	120 days
July 9	Rec. of NNSA Senior Technical Advisory Panel	Informed	90 days
July 9	Training and qual. of NNSA site office personnel	Report	30 days
July 9	LANL safety-class instr./control systems	Report	60 days
July 9	Implementation of SS-21 at Pantex	Briefing	ASAP
June 12	KAMS safety basis review	Report	60 days
June 12	Rec. 2000-2 implementation plan	Briefing	6 month
April 10	Hazard assessment and control at LLNL	Report	60 days
April 10	Sludge removal from the Hanford K-Basins	Report	60 days
April 4	Conduct of operations and training at Pantex	Report	60 days
March 25	Software quality assurance at Pantex	Report	30 days
March 27	Temperform quality assurance issues	Report	30 days
March 20	Recommendation 94-1 R&D Program	Report 6	0 days
March 7	INEEL Advanced Mixed Waste Treatment Project	Briefing	30 days
March 7	Flood mitigation at LANL	Report	90 days
February 14	Temperform heat-treated aluminum parts	Report/Plan	30/60 days
February 6	Proper sealing of the MCOs at Hanford	Report	15 days
January 24	Fire, Safety and Preparedness Action Plan	Report	30 days
January 9	HEPA filter testing protocols and procedures	Report	45 days

APPENDIX C
CORRESPONDENCE

Fernald Closure Project

August 7 letter to the Assistant Secretary for Environmental Management regarding worker safety.

Hanford Site

January 21 letter to the Assistant Secretary for Environmental Management regarding ground motion criteria.

February 6 letter to the Assistant Secretary for Environmental Management regarding multi-canister overpacks (MCOs).

March 7 letter to the Assistant Secretary for Environmental Management regarding electrical distribution instrumentation and control systems.

March 7 letter to the Assistant Secretary for Environmental Management regarding Advanced Mixed Waste Treatment project.

March 7 letter to the Assistant Secretary for Environmental Management regarding operational readiness reviews for fuel transfer system, Spent Nuclear Fuel project.

March 7 letter to the Assistant Secretary for Environmental Management regarding electrical distribution systems at WTP.

April 4 letter to the Assistant Secretary for Environmental Management regarding T-Plant seismic review.

April 10 letter to the Secretary of Energy regarding K-Basins sludge removal.

May 29 letter to the Manager, Office of River Protection, regarding safety management changes.

August 7 letter to the Assistant Secretary for Environmental Management regarding the status of Recommendation 2000-2.

November 7 letter to the Assistant Secretary for Environmental Management regarding transuranic waste retrieval.

Los Alamos National Laboratory

January 16 farewell letter from the Board to Mary Ann Rosenthal.

January 24 letter to the Secretary of Energy on the recommendations of the Department of Energy's Commission on Fire Safety and Preparedness.

March 7 letter to the Acting Administrator of NNSA regarding flood mitigation.

March 31 letter to the Acting Administrator of NNSA regarding funding for affects of Cerro Grande wildfire.

May 12 letter to the Acting Administrator of NNSA regarding development and design of the DynEx project.

July 9 letter to the Administrator of NNSA regarding LANL critical experiments facility.

August 1 letter to the Deputy Administrator for Defense Programs regarding aqueous processing of scrap plutonium-238 oxide.

August 7 letter to the Administrator of NNSA regarding work planning and practices.

August 19 letter to the Deputy Administrator for Defense Programs regarding electrical and lightning protection.

November 5 letter to the Administrator of NNSA regarding extension of response on lightning protection systems.

Lawrence Livermore National Laboratory

April 10 letter to the Acting Administrator of NNSA regarding hazard assessment and control.

Nevada Test Site

July 1 letter to the Administrator of NNSA regarding electrical and lightning protection.

Y-12 National Security Site

January 9 letter to the Secretary of Energy regarding high-efficiency particulate air filter testing.

October 16 letter to the Administrator of NNSA regarding Building 9212 operational safety requirements.

December 31 letter to the Deputy Administrator for Defense Programs regarding safety review of oxide conversion facility.

Pantex Plant

March 18 letter to the Acting Administrator of NNSA regarding implementation of fire safety controls.

March 25 letter to the Acting Administrator of NNSA regarding software quality assurance.

April 4 letter to the Acting Administrator of NNSA regarding conduct of operations and training.

July 9 letter to the Secretary of Energy regarding accelerated SS-21 tooling for W88 weapons.

July 9 letter to the Deputy Administrator for Defense Programs regarding NNSA and Pantex training issues.

July 10 letter to the Deputy Administrator for Defense Programs regarding hoisting and rigging.

October 10 letter to the Deputy Administrator for Defense Programs regarding Building 12-64 structural upgrade.

Rocky Flats Environmental Technology Site

July 31 letter to the Assistant Secretary for Environmental Management regarding combustibles in gloveboxes.

December 2 letter to the Secretary of Energy regarding glovebox fire.

Savannah River Site

Jun 6 letter to the Under Secretary of Energy, Science and Environment regarding Plutonium Finishing Plant IAEA swap dose consideration.

June 12 letter to the Secretary of Energy regarding safety basis review of plutonium material storage and support facilities (KAMS).

July 10 letter to the Assistant Secretary for Environmental Management regarding review of electrical and lightning protection and detection systems for KAMS.

August 14 letter to the Secretary of Energy regarding testing of high-efficiency particulate air filters at the filter testing facility.

Other Significant Correspondence With DOE

January 9 letter to the Secretary of Energy responding to DOE's quality assurance improvement plan for defense nuclear facilities.

March 20 letter to the Assistant Secretary for Environmental Management regarding Rec. 94-1 research and development funding.

March 27 letter to the Assistant Secretary for Environment, Safety and Health regarding quality assurance of Temperform heat-treated aluminum parts.

April 10 letter to the Secretary of Energy regarding Rec. 2001-1 quality assurance for safety-related software.

April 25 letter to the Secretary of Energy regarding suspect and counterfeit parts.

May 13 letter to the Acting Administrator of NNSA regarding documented safety analysis and criticality safety strategy for PDCF.

Jun 12 letter to the Secretary of Energy regarding site visits for Rec. 2000-2.

June 12 letter to the Assistant Secretary for Environmental Management regarding quality assurance improvement plan (QAIP).

July 9 letter to the Secretary of Energy regarding implementation plan for Rec. 2002-2.

July 9 letter to the Assistant Deputy Administrator for Military Applications and Stockpile Operations regarding NESS and readiness assessment for the W62 program.

July 14 letter to the Secretary of Energy regarding acceptance of implementation plan for Rec. 2002-3.

August 7 letter to the Assistant Secretary for Environment Safety and Health regarding DOE's electrical safety handbook.

August 7 letter to the Secretary of Energy regarding closing Rec. 97-2 (criticality safety).

August 25 letter to the Assistant Secretary for Environment, Safety and Health regarding Rec. 2002-3 commitment 4.1 acceptance.

November 13 letter to the Secretary of Energy regarding DNFSB/TECH-33, *Control of Red Oil Explosions in Defense Nuclear Facilities.*

December 8 letter to the Administrator of NNSA regarding the nuclear explosive safety study.

December 8 letter to the Secretary of Energy regarding administrative controls for Rec. 2002-3.

APPENDIX D
ADMINISTRATIVE ACTIVITIES

INFORMATION TECHNOLOGY AND SECURITY

The Board has continued to increase its use of advanced information technology (IT). Desktop hardware, software, and network servers provided to the staff are continually upgraded to ensure that the latest tools are available. The Board's internet website (www.dnfsb.gov) is kept current to ensure that public documents are available for viewing and download. The website also provides a link to live webcasts of the Board's public meetings, six in 2003. Video transmissions are archived so that they can be viewed at a later time.

The Board continues to place heightened emphasis on both IT and physical security. One key improvement made in 2003 was the establishment of an alternate operations facility, complete with current system backup and IT resources to support 15-20 staff members for an extended period of time. Security controls, including cipher locks to control physical access and a perimeter firewall to control network access, have been established and tested. In addition, the Board is working to provide secure remote access to its information systems so that mission-critical documents can be accessed from offsite locations.

STAFF

As of December 31, 2003, the Board employed 94 full-time staff in addition to the four full-time Board Members. The Board continued its aggressive recruitment program to attract the brightest engineering students from colleges and universities across the country, as well as experienced engineering professionals. This year, technical recruiters visited 10 campuses and 10 career fairs, and the Board continued its recruitment outreach program through the National Society of Black Engineers and Mexican-American Engineers and Scientists.

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 disputes economically.

HUMAN RESOURCES

The Board's ability to fulfill its safety mission rests heavily on attracting and retaining top-caliber technical staff. The Board has succeeded in creating a work environment that emphasizes excellence as the standard for staff performance, and has rewarded its staff accordingly. The pay banding and pay for performance programs developed and implemented by the Board have proven to be effective in hiring technical talent, holding employees accountable for their performance, and rewarding outstanding performance on the job.

The Board's enabling legislation grants authority for excepted service hiring and classification. Using this authority, along with recruitment and relocation bonuses, student loan

repayments, and retention allowances, the Board has been successful in competing for scientific and technical staff in a competitive employment market.

Competition from the private sector and fiscal constraints make recruiting and retaining a high-quality, diverse workforce a challenge. Competition for top engineering professionals is intense. Even with the special hiring and pay authorities granted to the Board, private industry can easily promise higher salaries and benefits. The Board has also found that the federal downsizing campaigns of the 1990s, coupled with the perception that the federal bureaucracy stifles creativity and fails to encourage and reward outstanding work, have damaged its recruiting campaigns. Recruitment and retention of recent college engineering graduates, especially women and minorities, is difficult in the current job market, and will become even more challenging with the renewed activity in the commercial nuclear industry.

Despite these problems, 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 a licensed professional engineer.

Seven technical staff members are located at priority DOE sites. There is one site representative at the Pantex Plant near Amarillo, Texas; two at Hanford near Richland, Washington; two at SRS near Aiken, South Carolina; and one each at Y-12 in Oak Ridge, Tennessee, and LANL in New Mexico.

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 percent of the Board's senior technical and legal staff hold advanced science and engineering degrees, 33 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-school education and intensive on-the-job training guided by experienced technical mentors. Currently, there are 11 entry-level employees in this program. Three completed their master's degrees in the summer of 2003 and are in their third-year field assignment. By the summer of 2004, five more of these individuals should be awarded a master's degree in an engineering discipline. 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.

APPENDIX E
Acronyms and Abbreviations

Board	Defense Nuclear Facilities Safety Board
CFR	Code of Federal Regulations
D&D	Deactivation and Decommissioning
DOE	Department of Energy
DSA	Documented Safety Analysis
FY	Fiscal Year
Hanford	Hanford Reservation
HEPA	High Efficiency Particulate Air
HEUMF	Highly Enriched Uranium Materials Facility
HLW	High-level Waste
IAWG	Inactive Actinides Working Group
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology Engineering Center
ISM	Integrated Safety Management
IT	Information Technology
KAMS	K-Area Material Storage
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
MCOs	Multi-Canister Overpacks
NESS	Nuclear Explosive Safety Studies
NNSA	National Nuclear Security Administration
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
Pantex	Pantex Plant
PDCF	Pit Disassembly and Conversion Facility
Pu-238, 239	Plutonium-238, 239
QA	Quality Assurance
RR	Readiness Review
RFETS	Rocky Flats Environmental Technology Site
SNFP	Spent Nuclear Fuel Project
SQA	Software Quality Assurance
SRS	Savannah River Site
SS-21	Seamless Safety for the 21st Century
TA	Technical Area
TEF	Tritium Extraction Facility
TRU	Transuranic
U-233	Uranium-233
USQ	Unreviewed Safety Question
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment Plant
Y-12	Y-12 National Security Complex