
TENTH ANNUAL REPORT
TO CONGRESS

**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**



FEBRUARY 2000

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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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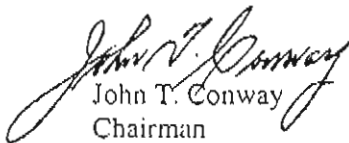
February 25, 2000


To the Congress of the United States:

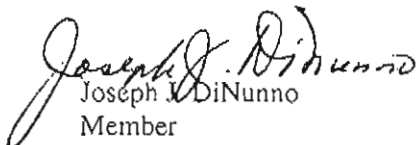
The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to Congress its tenth Annual Report. The Board is an independent executive branch establishment responsible for providing advice and recommendations to the Secretary of Energy, and to the President if necessary, regarding public 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 1999, assesses improvements in the safety of DOE defense nuclear facilities, and identifies remaining safety problems.

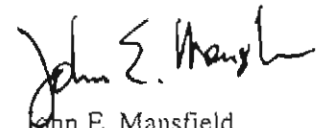
Respectfully submitted,


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PREFACE

The Atomic Energy Act of 1954 as amended (Section 316) requires the Defense Nuclear Facilities Safety Board (Board) to submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a written report each year concerning its activities. In addition to setting forth all recommendations made by the Board during the preceding year, the Annual Report is required to include an assessment of:

- (A) the improvements in the safety of Department of Energy defense nuclear facilities during the period covered by the report;
- (B) the improvements in the safety of Department of Energy defense nuclear facilities resulting from actions taken by the Board or taken on the basis of the activities of the Board; and
- (C) the outstanding safety problems, if any, of Department of Energy defense nuclear facilities.

EXECUTIVE SUMMARY

During this past year, the Defense Nuclear Facilities Safety Board (Board) has seen significant progress by the Department of Energy (DOE) in upgrading its safety management program. The cumulative effects of the Board's initiatives and DOE's positive responses have been increasingly evident at defense nuclear facilities.

In keeping with the Government Performance and Results Act (GPRA) and its enabling statute, the Board has established safety goals as a focus for all safety oversight activities and strategic planning. The Board's three strategic areas of concentration are as follows:

- ! Complex-wide health and safety issues,
- ! Management and stewardship of the nation's nuclear stockpile and nuclear weapons components, and
- ! Hazardous remnants of weapons production.

DOE's prime defense mission during 1999 continued to be stewardship of the nation's nuclear arsenal. DOE also continued its ongoing work to decontaminate and decommission nuclear facilities no longer needed. The Board gave priority attention to DOE's safety management of these major activities, as well as the need to stabilize hazardous materials remaining from previous operations. The following sections summarize the Board's principal actions in each of these areas during 1999.

COMPLEX-WIDE HEALTH AND SAFETY ISSUES

- ! Significant progress was made in implementing systems based on the concept of Integrated Safety Management (ISM). The requisite framework for ISM has been established and its successful application verified at most major sites in the defense nuclear complex. Roles and responsibilities have been clarified, guidance has been updated, and programs to measure effectiveness and establish accountability for the federal workforce and site contractors are maturing. Most sites have in place at least the basic elements of an acceptable ISM System. More work remains to be done to embed the functions and principles of ISM deeply into the planning and execution of work at all levels of an organization, thereby achieving the goal of enhanced safety for the public, workers, and the environment. Secretary of Energy Bill Richardson has tasked the complex with implementation of the ISM concept at all DOE facilities by September 2000—a commendable goal.
- ! The key objective of ISM is to improve the safety of operations at defense nuclear facilities. This is done by linking work planning more closely with safety planning and by clearly establishing controls necessary to protect the public, workers, and the environment in performing hazardous tasks. The Board has continued to stress the

importance of developing Authorization Agreements that define specific safety controls for high-hazard defense nuclear facilities. More than 100 facilities or major activities are now operating within the bounds of Authorization Agreements. This accomplishment by DOE is a notable outcome of the ISM effort and a substantive measure of the concept's successful implementation.

- ! The Board has focused considerable attention on DOE's progress in implementing ISM through an effective program of obtaining feedback from operating experience and applying that feedback to improve the safety of ongoing and future work at DOE's facilities and sites. As a result of the Board's actions, DOE has clarified its roles and responsibilities for feedback and improvement, established formal processes for addressing and tracking safety issues, and improved programs to profit from lessons learned.

- ! DOE's efforts to upgrade safety management in 1999 included enhanced enforcement of nuclear safety requirements. As part of this effort, DOE revived earlier attempts to issue some of its safety requirements through rulemaking, hence bringing them under the enforcement provisions of the Price-Anderson Amendments Act. These same requirements are now established as contract terms and conditions, and form a fundamental component of requirements associated with ISM. The Board has counseled DOE to ensure that the rulemaking complements—not jeopardizes—the comprehensive ISM upgrade program under way, and that regulatory enforcement of any new nuclear safety requirements is integrated with contract enforcement programs recently published in Department of Energy Acquisition Regulations. Integrating the rule into ISM may be difficult to accomplish. The Board has reviewed the draft rule, preamble, and associated guides. The Board's staff has provided DOE with suggested language in several areas, including nuclear explosive safety and facility deactivation activities.

- ! Staff reviews and the Board's interactions with DOE have resulted in DOE's consolidating, integrating, and updating health and safety directives for the protection of workers and the public. For example, DOE revised or developed 18 directives in support of the amended rule, 10 CFR Part 835, *Occupational Radiation Protection*, or as a result of periodic review and update. The Board reviewed and commented on these directives. As a result of improvements derived through these reviews and repeated interaction with DOE, guidance in support of this important safety management function was clarified and strengthened to provide more effective tools for the protection of workers.

- ! In June 1993, the Board issued Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*. In its implementation of this recommendation, DOE has developed and instituted a standardized technical qualification program for approximately 1,800 federal employees, identified 251 senior technical safety management positions, and pursued and been granted an excepted service hiring authority for an additional 200 positions (in addition to the 200 positions allowed under the DOE Reorganization Act). Although federal staffing

of DOE offices has generally been decreasing, some offices have identified critical staffing needs, conducted nationwide searches, and successfully hired technically outstanding employees in areas important to safety at defense nuclear facilities. DOE has made significant strides in improving the technical competence of federal employees in areas important to safety at defense nuclear facilities, and has taken notable steps toward institutionalizing the Federal Technical Capability Program. Having determined that the objectives of its recommendation had been met, the Board closed Recommendation 93-3 in November 1999.

- ! The Board continues to devote attention to certain developments affecting the future viability of DOE's programs for prevention of criticality accidents. These developments follow recent DOE studies that raise security questions as to limiting the use of the criticality facility at the Los Alamos National Laboratory. The Board will maintain the position that no steps in remediation of this situation should weaken the program of training the criticality engineers needed to prevent criticality accidents in DOE's facilities.
- ! Confinement ventilation systems are important safety features of DOE facilities in which hazardous materials are handled in dispersible form. High-efficiency particulate air (HEPA) filters are critical elements of such systems. Because HEPA filters are the final physical barrier to the release of material to the atmosphere, they serve a vital function in protecting the public, workers, and the environment. In May 1999, the Board issued DNFSB/TECH-23, *HEPA Filters Used in the Department of Energy's Hazardous Facilities*, addressing a number of potentially significant weaknesses in the maintenance and operation of confinement ventilation systems, particularly in the procurement, application, and use of HEPA filters. In its forwarding letter, the Board called on DOE to provide a report addressing the weaknesses identified in DNFSB/TECH-23. DOE provided a partial response on December 6, 1999, and at year's end was developing a supplemental report.
- ! The Board's oversight and timely intervention in dealing with suspect/counterfeit items have been pivotal in re-energizing DOE's quality assurance program, which is vital to ensuring public health and safety at DOE's defense nuclear facilities. Additionally, the Board's inquiries into issues raised by a concerned individual regarding temporary storage of low-level radioactive waste led to more effective control of storage conditions for low-level radioactive wastes.

MANAGEMENT AND STEWARDSHIP OF THE NATION'S NUCLEAR STOCKPILE AND NUCLEAR WEAPONS COMPONENTS

- ! During the past year, the Board and its staff conducted numerous assessments of the safety of specific nuclear explosive activities at the Pantex Plant. These reviews, which included the W56 dismantlement, the W87 Life Extension Program, and the W62 disassembly and inspection program, revealed safety-related issues in areas such as the adequacy of safety analyses and controls, the flowdown of controls into

operating-level procedures, and the readiness of activities to operate safely. The Board's involvement has contributed to DOE's improvement of the safety of these operations.

- ! The Board has recently focused attention on DOE's rapidly diminishing capability at defense nuclear facilities to safely perform the work necessary to dispose of damaged nuclear devices should such a contingency arise. In the past, maintenance of the facilities and personnel necessary to support this mission depended on the availability of a technical staff skilled in nuclear test operations. However, the infrastructure of personnel and facilities required to support nuclear testing operations is quickly disappearing. The Board counseled DOE to plan alternative means of dealing with such an emergency should it arise. DOE has agreed to address this need and is increasing its contingency planning efforts.
- ! In late 1998, the Board issued Recommendation 98-2, *Safety Management at the Pantex Plant*, urging DOE to take fundamental actions to improve the safety of all weapons-related work at the Pantex Plant. Foremost among the Board's specific recommendations was that DOE increase the formality of the processes designed to ensure the safety of activities at Pantex so that resultant safety improvements will be expedited and accelerated. DOE accepted Recommendation 98-2 and made specific commitments to improve safety management at Pantex, including accelerated efforts to establish weapon-specific safety bases for all ongoing activities at the plant.
- ! On the basis of evaluations from its staff, the Board concluded that actions to improve chemical safety at the Oak Ridge Y-12 Plant were not keeping pace with those at other defense nuclear sites or with the Secretary of Energy's published expectations. After the Board communicated its concern, DOE stepped up actions to complete a chemical management program at the Y-12 Plant, including a renewed commitment to characterize chemical inventories for emergency planning purposes and to dispose of excess chemicals. As part of its continuing pursuit of this issue, the Board participated in a DOE workshop focused on upgrading chemical safety throughout the defense nuclear complex.
- ! The Board continued to assist DOE in addressing potential lightning hazards to nuclear explosive operations at Pantex. During 1999, DOE's lightning protection project team (which was established in response to the Board's reporting requirement) completed a comprehensive investigation and report detailing the threat of lightning to nuclear explosives at Pantex, analyzing potential controls and mitigating measures, and summarizing the actions DOE considers necessary to protect nuclear explosive operations at Pantex from lightning threats. During this same period, DOE upgraded its lightning protection measures at the plant.
- ! In early 1999, in response to a suggestion from the Board, DOE developed and published a standard for conducting and documenting hazard analyses for nuclear explosive operations. This important directive sets forth DOE's fundamental expectations in this area, and provides guidance on how to establish and document a

safety basis ensuring that hazardous activities involving nuclear explosives can be completed safely.

- ! Pit inventories are growing at the Pantex Plant. Poor programmatic direction and management have led to large expenditures with little corresponding improvement in the storage conditions of the pits. Because of the safety implications of inadequate pit storage conditions, the Board issued Recommendation 99-1, *Safe Storage of Fissionable Materials Called "Pits,"* on August 11, 1999. The Board recommended that attention and resources be directed at the expeditious repackaging of pits into acceptable storage containers. In response to Recommendation 99-1, DOE has drafted an Implementation Plan that partially addresses the Board's recommendation. The Board's staff is closely monitoring DOE's development efforts, and expects to receive an adequate plan and to see the institution of a repackaging program in 2000.

HAZARDOUS REMNANTS OF WEAPONS PRODUCTION

- ! After numerous interactions with the Board and its staff, DOE issued a revised plan and schedule for addressing the many health and safety risks, originally identified by the Board in Recommendation 94-1, posed by the highest-priority legacy materials stored throughout the DOE nuclear weapons complex. The Board identified deficiencies in the new plan and found that site-level planning did not support several significant commitments. Throughout 1999, the Board engaged DOE on these issues in an attempt to obtain a clear, concise plan for stabilization of these legacy materials. Lack of progress led the Board to issue Recommendation 2000-1, *Prioritization for Stabilizing Nuclear Material*, which recommends a prioritization scheme based upon risk considerations. Even though DOE's revised 1999 plan did not provide a path forward for stabilization and safe storage of all legacy materials, progress was made in reducing the risk of a large quantity of material. DOE has been able to complete the following risk reduction activities:
 - At the Rocky Flats Environmental Technology Site (RFETS), DOE has processed all plutonium-bearing solutions at the site except for a small amount held up in Building 771; completed stabilization of all high-risk residues; and stabilized more than 6 metric tons of salt residues, 9 metric tons of ash residues, 8 metric tons of combustible residues, and 12 metric tons of dry residues.
 - At the Hanford Site, DOE has commenced stabilization of plutonium oxide material and plutonium-bearing solutions; established a reasonable path forward for the remaining stabilization activities; and made major progress in the construction of fuel retrieval and stabilization facilities at the K-Basins.
 - At the Savannah River Site (SRS), DOE has completed the packaging of all plutonium metal items into welded stainless steel cans that will serve as the inner containers to meet DOE-STD-3013. DOE also completed stabilization of miscellaneous plutonium metal items, dissolution of plutonium sweepings, and 60

containers of RFETS sand, slag, and crucible residues. In addition, it has dissolved the last of the low-irradiated Mark 16/22 spent fuel assemblies, and completed the laboratory testing and preliminary design of a system for vitrification of highly radioactive americium-curium solutions.

- ! In spring 1999, the Board's continuing review of operational data for DOE defense nuclear facilities revealed a negative trend in control of work and operations at SRS. The Board brought this issue to DOE's attention in a letter dated June 2, 1999, stating that a broader look at the underlying causes of this trend and a systematic understanding of those causes would be required to correct weaknesses in performance. In response, DOE has undertaken corrective actions to reverse this trend and ensure a sustained, satisfactory level of performance in this area.
- ! In 1994 the Board issued Recommendation 94-3, *Rocky Flats Plutonium Storage*, to help ensure that the large quantity of plutonium at RFETS would be safely stored. The Board recommended that DOE take a systematic approach to evaluating the suitability of Building 371 for the proposed new mission of storing the site's entire plutonium inventory, and prepare a program plan for building upgrades and improvements consistent with that mission. As a result of the Board's recommendation, upgrades to the building's structure, systems, and components, as well as the safety basis, were completed during 1999. The Board now considers the safety management provisions for Building 371 adequate for the building's current storage mission, and accordingly has closed Recommendation 94-3.
- ! As a result of the Board's Recommendation 97-1, *Uranium-233 Storage Safety at Department of Energy Facilities*, DOE took action to reduce safety risks and uncertainties associated with storage of uranium-233 (U-233) at a number of sites. For example, U-233 material at Los Alamos National Laboratory was relocated to a more suitable area; testing of U-233 fuel pellets at Idaho National Engineering and Environmental Laboratory was completed to establish safe near-term storage; the first fire hazards analysis for storage of high-risk U-233 in Oak Ridge National Laboratory's Building 3019 was conducted; a large portion of construction activities within Building 3019 required for characterization of high-risk U-233 was completed; a draft U-233 storage standard was issued; and a multiyear management and technical plan for the U-233 safe storage program was issued. These actions should help ensure safe storage of this material.
- ! The Board and its staff worked closely with DOE to institutionalize the changes needed to improve DOE's radioactive waste management program through issuance of a comprehensive new directive, DOE Order 430.1, *Radioactive Waste Management*. Compliance with this directive should improve DOE's management of all radioactive waste types. Issuance of this directive represents the culmination of several years of effort to implement the Board's Recommendation 94-2, *Low-Level Waste Disposal*. This accomplishment, along with progress by DOE in other aspects of low-level waste management, allowed the Board to close this recommendation in December 1999.

- ! During 1999, the Board evaluated the safety of two new nuclear facilities at SRS—the Replacement High-Level Waste Evaporator and the K-Area Materials Storage Facility (KAMS). The Board and its staff thoroughly reviewed the facilities’ design and construction, safety systems and controls, operating procedures, operator readiness, and observed DOE’s Operational Readiness Reviews. The Board concluded that both facilities should be ready to operate safely once pre-start findings have been resolved, but also noted several matters that will need to be addressed to ensure continued safe operations (e.g., the need for a sound container surveillance program at KAMS).

- ! The Board has continued to press DOE to resolve the health and safety issues arising from storage of high-level waste in tanks at the Hanford Site. In 1999, the Board worked closely with DOE to develop a sound strategy for narrowing the remaining safety-related uncertainties in the characterization of these wastes and for mitigating problems from possible retention of flammable gas. Because of DOE’s progress on these characterization issues, the Board’s Recommendation 93-5, *Hanford Waste Tanks Characterization Studies*, was closed on November 15, 1999.

- ! Decommissioning activities are being conducted in several buildings at RFETS. The Board noted that safety controls for the protection of workers did not provide the desired level of protection and that there was an overreliance on personal protective equipment (e.g., respirators) instead of engineered controls to eliminate or mitigate hazards. Furthermore, when engineered controls (e.g., air movers) were used, they were not adequately analyzed to ensure that they would have the desired result. As a consequence of the Board’s attention to this issue, enhanced engineered controls are now being applied more appropriately by DOE contractors in the demolition of contaminated equipment at the site.

- ! During 1999, the Board evaluated radiation protection in decommissioning of areas at the Miamisburg Environmental Management Project (MEMP) that are suspected of being contaminated with tritium compounds. As a result of the staff’s visits and subsequent information exchanges, the MEMP contractor prepared a corrective action plan. Work is proceeding to resolve these issues before major decommissioning involving such tritium compounds begins in early 2000. Because similar technical issues may also apply to other defense nuclear facilities, the Board suggested that DOE articulate a technical position on the hazards specific to metal tritides to ensure that appropriate measures are implemented across the defense nuclear facilities complex. In response, DOE informed field offices of the issue and developed an approach that is expected to lead to the promulgation of needed formal requirements and guidance.

- ! In a review of the deactivation of the Hanford 233-S Facility, the Board’s staff identified a substantial underestimation of the amount of dispersible plutonium contamination. The contractor has initiated changes to the safety basis for the cleanup. The Board has requested that DOE describe actions to correct the programmatic deficiencies that led to the improper hazard identification.

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1. INTRODUCTION

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1.1 BACKGROUND

In the late 1980s, a number of public health and nuclear safety issues at aging defense nuclear facilities operated by the Department of Energy (DOE) led Congress to create the five-member Defense Nuclear Facilities Safety Board (Board). The Board began functioning in late October 1989 with the swearing in of the Board's charter members. To help ensure adequate protection of the health and safety of the public and workers, the Board is empowered to oversee DOE's programs for managing the safety of its defense nuclear facilities. A major goal of the Board is to ensure that, in carrying out its mandate for maintaining the nation's nuclear weapons stockpile, DOE does so safely.

1.1.1 Board Responsibilities

The Board is responsible for independent oversight of the management by DOE of the safety of all defense nuclear and related activities. DOE continues to be actively engaged in the disassembly of numerous nuclear weapons while maintaining the remaining weapons in the stockpile in a safe and reliable condition, and in the conduct of research to ensure the continued safety of DOE's stewardship of the stockpile. DOE also pursues safe disposition of fissionable material removed from dismantled weapons and of hazardous material remaining in facilities that abruptly ceased production activities more than 9 years ago. As in recent years, many of DOE's current activities are associated with characterization, stabilization, and safe storage of special nuclear materials; facility deactivation; and safe management of radioactive wastes.

The law establishing the Board, 42 U.S.C. § 2286, *et seq.*, requires the Board to review and evaluate the content and implementation of health and safety standards relating to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities, and to make recommendations to the Secretary of Energy that are necessary to ensure adequate protection of public health and safety. In making recommendations, the Board must consider the

technical and economic feasibility of their implementation, while the Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary or stockpile management considerations. If the Board determines that there is an imminent or severe threat to public health and safety, it must transmit its recommendations to the President, the Secretaries of Energy and Defense, and the Congress.

1.1.2 Powers of the Board

In the legislative history of the Board's enabling statute, Congress gave guidance on how the Board was expected to carry out its functions. Congress chose to provide the Board with action-forcing rather than regulatory powers. Congress anticipated that in exercising these powers, the Board would help ensure that DOE safely manages the production, use, and storage of defense nuclear materials and attendant nuclear waste streams, to ensure protection of worker and public health and safety. Congress was aware that the safety policies and standards issued by DOE needed upgrading, and that operations by DOE and its contractors had in the past left extensive residual contamination in buildings and their environs. Congress also expected the Board to help raise the technical expertise of DOE's staff and to assist and monitor the continued development of DOE's internal Environment, Safety and Health (ES&H) organization.

Its enabling statute empowers the Board to conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, establish reporting requirements for DOE, and take other actions in furtherance of its review responsibilities. The law requires DOE to give the Board its full cooperation.

The Board's review and advisory responsibilities apply throughout the life cycle of DOE's defense nuclear facilities, covering design, construction, operation, and decommissioning. The Board is also required to recommend to the Secretary of Energy any specific measures, such as changes in the content and implementation of those standards, that it believes should be adopted to ensure that public health and safety are adequately protected. In addition, the statute mandates that the Board review the design of new defense nuclear facilities and modifications to older facilities before the start of construction and recommend any changes found necessary to ensure adequate protection of the health and safety of the public.

1.1.3 Avoidance of Interference with DOE Functions

The Board recognizes that in performing its essential national defense work, DOE must not be hampered by unwarranted delay. The Board has been able to keep its safety reviews synchronized with DOE's activities by timely assignment of its staff to monitor and review work involving design, construction, preparations for readiness to operate, operations in facilities, and decommissioning of facilities. The technical staffs of the Board and of DOE and its contractors frequently resolve technical issues that arise during these reviews without the need for formal action-forcing measures by the Board. If the Board identifies safety issues that must be resolved before work may proceed, it can, and frequently does, formally define those issues and suggest that they be resolved by DOE.

1.1.4 Formal Mode of Communication

The Board communicates the most substantive of its findings to DOE using the formal recommendation process set forth in the Board's enabling statute. These recommendations describe safety matters meriting Secretarial attention and provide guidance on what the Board considers to be advisable solutions. The Secretary may either accept a recommendation from the Board or reject a recommendation, requesting that the Board reconsider; to date, however, no Secretary has found cause to reject a Board recommendation. Following the Secretary's acceptance of a recommendation, a mutually acceptable plan of action is established. The Board monitors the progress of each step in implementation of the mutually agreed-upon plan until the committed actions have been completed. As of the end of the year, the Board had issued and DOE had accepted 39 sets of recommendations containing 178 specific recommendations. DOE has completed most of these recommendations and is making progress in implementing others, although at times more slowly than agreed upon. During the last year, the Board closed six of its recommendations (93-3, 93-5, 94-2, 94-3, 94-5, and 95-1), and continued its follow-up of seven recommendations (92-4, 94-1, 95-2, 96-1, 97-1, 97-2, 98-1, and 98-2). The Board is awaiting the issuance of DOE Implementation Plans for two recent recommendations (99-1 and 2000-1). The status of actions on the Board's recommendations during 1999 is presented in Table 1.

Table 1. Status of Board's Recommendations

Number	Subject	Status
92-4	Multi-Function Waste Tank Facility at the Hanford Site	In Progress
93-3	Operational Readiness of the HB-Line at the Savannah River Site	Closed
93-5	Hanford Waste Tanks Characterization Studies	Closed
94-1	Improved Schedule for Remediation in Defense Nuclear Facilities Complex	In Progress
94-2	Low-Level Waste Disposal	Closed
94-3	Rocky Flats Plutonium Storage	Closed
94-5	Integration of DOE Safety Rules, Orders, and Other Requirements	Closed
95-1	Improved Safety of Cylinders Containing Depleted Uranium	Closed
95-2	Safety Management	In Progress
96-1	In-Tank Precipitation System at the Savannah River Site	In Progress
97-1	Uranium-233 Storage Safety at Department of Energy Facilities	In Progress
97-2	Criticality Safety	In Progress
98-1	Integrated Safety Management	In Progress
98-2	Safety Management at the Pantex Plant	In Progress
99-1	Safe Storage of Fissionable Materials Called "Pits"	Implementation Plan Pending
2000-1	Prioritization for Stabilizing Nuclear Material	Implementation Plan Pending

1.1.5 Nature of the Board's Work

The Board's primary function is to assist DOE in upgrading its management of safety at its defense nuclear facilities. The integration of work planning and safety planning is a

fundamental objective. The Board remains closely attuned to the content and implementation of DOE standards for the planning and execution of DOE's defense nuclear programs, gathering information from a broad range of sources. These sources include, but are not limited to:

- ! On-site technical evaluations, reviews, and observations by the Board and its staff.
- ! Critical review of DOE safety analyses and proposed safety control schemes by the Board, its staff, and competent technical experts.
- ! Public meetings at Board Headquarters and in the field.
- ! Daily input from the Board's Site Representatives, as well as their weekly summary reports, which are placed on the public record.

The Board has optimized its resources by assigning Site Representatives to five high-priority defense nuclear sites. In addition, extensive travel by the Board and its technical staff to defense nuclear facilities remains essential for the Board to accomplish its safety oversight mission through direct observation of facilities and activities, and through interactions with the public, workers, and officials at defense nuclear facilities.

To remain better informed about DOE's activities and initiatives, the Board also receives regular briefings by senior DOE officials. The Board uses information from these briefings to synchronize its oversight of DOE's priority programs, to gauge progress being made on safety, and to monitor upgrade programs to which DOE has committed.

On the basis of information gained from the above sources, the Board chooses from the spectrum of action-forcing mechanisms granted to it by law to formally communicate its observations and advice, and to promote appropriate corrective actions by DOE. These action-forcing mechanisms include the Board's recommendations to the Secretary of Energy, requests for reports from DOE, public meetings or hearings, technical exchanges, and issuance of technical reports, investigations, and testimony to congressional committees. In addition, the Board often sends DOE reports prepared by its staff, thereby sharing the staff's observations and findings.

Individual Board Members and the Board's staff also engage in direct technical dialogue with DOE and its contractors on specific safety-related matters, and participate in technical workshops and conferences where information relevant to safety improvement and risk reduction is exchanged. The Board has directed its senior staff members to meet frequently with their DOE counterparts to ensure that the staff is aware of and able to brief the Board on the status of safety issues and programs and on key safety questions, and that DOE understands the Board's safety objectives and initiatives. This type of direct interaction conserves federal resources by ensuring that DOE and the Board understand each other's positions in depth. This understanding, in turn, permits the Board to focus its recommendations, letters, requests for information, and public meetings and hearings on the most important health and safety issues to be addressed. It averts the waste of resources of both DOE and the Board on false starts and contention over easily resolved side-issues. In many cases, the simple exchange of ideas is

sufficient to motivate DOE to take appropriate actions without the Board having to make formal recommendations.

In addition to the broad scope of the Board's communications with DOE, the Board has exchanged information with other government agencies (e.g., Nuclear Regulatory Commission, General Accounting Office, Office of Management and Budget, Department of Defense, Environmental Protection Agency, and Department of the Navy's Strategic Systems Program Office), as well as outside agencies (e.g., National Research Council and National Academy for Public Administration). Such interactions facilitate the exchange of knowledge, experience, and factual information on matters involving the safety of DOE's defense nuclear facilities.

The Board remains committed to this policy of enhanced communication in the belief that in the end, safety is best served by spending federal dollars on real improvements at defense nuclear facilities, not on correspondence. Direct communication and discussions with DOE in an open forum have proven to be powerful, cost-effective tools for advancing the Board's nuclear safety initiatives. During 1999, the Board held four public meetings involving substantive interactions with senior DOE officials.

1.2 BOARD'S STRATEGIC PLANNING

In 1993, the Government Performance and Results Act (GPRA) was enacted. GPRA requires federal agencies to develop strategic plans that articulate the agency's mission and goals, as well as proposed methods for achieving its goals. The first edition of each agency's 5-year strategic plan was to be submitted by the end of September 1997. Furthermore, starting with FY 1999, agencies are required by GPRA to submit annual performance plans to the Office of Management and Budget that establish target levels of performance for program activities.

Performance target levels are required to be defined in objective, measurable terms so that actual achievement can compare against the targets. Agencies are required to report their performance annually to the President and Congress, comparing program achievements with the targets specified in their performance plans. Whenever a target has not been met, these performance reports must explain why and describe actions needed to achieve the unmet goals.

1.2.1 Board's Planning Goals

The Board has developed seven general outcome goals that describe the intended results, effects, or consequences from its oversight activities. Using its action-forcing powers, the Board seeks to achieve the following goals:

1. The safety of nuclear weapons at DOE defense nuclear facilities will continue to be assured.
2. Events or practices at hazardous DOE defense nuclear facilities that have adversely affected or may adversely affect public health and safety will be identified, and, as

needed, recommendations will be made to the Secretary of Energy identifying technically and economically feasible measures to address these hazards.

3. A flexible and adaptable DOE standards-based safety management program will be established that incorporates recognized good nuclear safety practices and allows for integration of work and safety planning for work that DOE and contractors perform at DOE's hazardous defense nuclear facilities.
4. DOE's technical expertise will be improved to permit DOE to better manage the hazardous work associated with defense nuclear facilities.
5. Integrated Safety Management programs will be implemented for operations at defense nuclear facilities, with processes and controls tailored to the hazards involved.¹
6. New defense nuclear facilities under design or construction will meet appropriate safety standards.
7. Facilities used in the past for defense nuclear purposes will be safely cleaned up and deactivated in such a manner as to permit safe eventual disposition.

These outcome goals serve as the primary drivers for all oversight activities the Board has planned for FY 1999 and beyond. The Board focuses its actions on those activities and facilities that have reached a stage of development that is best suited to constructive safety oversight, and on those operations for which safety improvements offer the greatest potential for risk reduction.

1.2.2 Board's Strategic Plan

In accordance with the requirements of GPRA and the guidance of the Office of Management and Budget, the Board issued its first strategic plan in September 1997. That plan set forth the Board's mission according to its congressional mandate, the nature of the Board's work, the Board's planning assumptions and external factors with a potential impact on planning, and the oversight principles and general goals under which the Board's oversight mission is conducted. In addition, the plan identified the Board's three strategic areas of concentration for the period FY 1997–FY 2002:

- ! Complex-wide health and safety issues,
- ! Management and stewardship of the nation's nuclear stockpile and nuclear weapons components, and

¹ Integrated Safety Management is the means by which DOE is institutionalizing the process of incorporating into the planning and execution of every major defense nuclear activity involving hazardous activities those controls necessary to ensure that environment, safety, and health objectives are achieved.

! Hazardous remnants of weapons production.

This Annual Report is structured according to the above three strategic areas of concentration.

In planning work in these three strategic areas of concentration, the Board and its staff have developed a set of seven strategic objectives and sixteen associated action plans that, in the aggregate, support implementation of the general goals noted above. As required by GPRA, the Board and its staff further refined their planning for the FY 1999 and FY 2000 budget requests to produce measurable performance goals that, when executed, will demonstrate progress toward the Board's strategic objectives in each area of concentration, and consequently toward its general goals. The first GPRA required performance reports, addressing each agency's FY 1999 performance goals, are due to the President and Congress by March 31, 2000. The Board's performance report will indicate that the Board met all of its FY 1999 performance goals.

It is anticipated that during each annual performance reporting period, DOE's mission and associated schedules for major actions will continue to change and that the Board's independent evaluations will require adjustments accordingly. As this occurs, the Board may be required to redeploy resources within and among the primary areas of concentration addressed in the Board's strategic plan. The specific facility or activity that is the focus of a performance plan action may change; however, the same or an increased level of performance and output should be achieved in support of the Board's general outcome goals.

In addition to changes in DOE's mission and schedule and the emergence of new safety concerns, other external forces have the potential to influence the Board's execution of its strategic plan and annual performance plans. In particular, the Board must retain the flexibility to respond if there were a major accident or other safety-significant event involving special nuclear material at a DOE facility. Such an event could necessitate an expeditious reallocation of resources and a substantive revision to the Board's performance planning goals, and could impact the Board's strategic plan objectives and action plan as well.

2. COMPLEX-WIDE HEALTH AND SAFETY ISSUES

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2.1 SAFETY MANAGEMENT UPGRADE PROGRAM

The Board devoted a substantial portion of its resources during 1999, as in previous years, to advising and assisting DOE in the upgrade of its internal safety management program. This activity was focused on:

- ! Implementing standards-based safety management programs that integrate work planning and safety planning, and that treat requirements for protection of the public, workers, and the environment from all hazards, including chemical and nuclear, in a holistic way.
- ! Upgrading the safety content of DOE's substantial body of existing safety management directives.
- ! Recruiting and retaining highly qualified technical personnel, and upgrading the technical competencies of DOE's workforce.

2.2 INTEGRATED SAFETY MANAGEMENT

In 1995, the Board issued Recommendation 95-2, *Safety Management*, to urge DOE to integrate work planning and safety planning more effectively. The methodology that evolved from this recommendation and DOE's Implementation Plan is termed Integrated Safety Management (ISM). The term "integrated" is used to indicate that all aspects of safety and work

planning and performance are integrated into a single process under the responsibility of line management. ISM provides a more effective way for DOE to discharge its responsibilities for protecting the public, workers, and the environment. To amplify Recommendation 95-2, the Board issued DNFSB/TECH-16, *Integrated Safety Management*, which sets forth a more detailed vision of what can be accomplished through ISM.

As noted, ISM represents an attempt to provide a single safety management program rather than multiple, unintegrated programs. It is a structured, comprehensive, common-sense approach to performing work safely. Through ISM, the Board has encouraged DOE to capture the essence of good practices developed for each of the sectors to be protected—the public, workers, and the environment—as well as the major types of hazards—nuclear, chemical, and physical—and to effect these practices as an integrated whole. The Board recognizes that DOE’s missions involve widely varying degrees of risk and hazard, and that requirements based on a concept of “one size fits all” will not succeed. Instead, through ISM, DOE can address any type of hazard encountered in the defense nuclear complex by combining work planning and safety planning, and establishing in advance the controls necessary for protection of the public, workers, and the environment.

Secretary of Energy Hazel O’Leary accepted the Board’s Recommendation 95-2, and in April 1996 provided an Implementation Plan, developed in collaboration with the Board, for moving forward. Her successor, Secretary Federico Peña, reaffirmed DOE’s commitment to ISM and issued DOE Policy 450.6, *Secretarial Policy Statement: Environment, Safety and Health*, making the implementation of the concept a requirement for all of DOE’s hazardous activities in the complex, nuclear and otherwise. In 1998, Secretary Bill Richardson reinforced these earlier initiatives by issuing strong statements in support of DOE’s continuing actions to upgrade its safety management program. In 1999 Secretary Richardson tasked the DOE complex to implement ISM at every DOE facility by September 2000.

The basic tenets of ISM are expressed in the Implementation Plan for Recommendation 95-2 and are captured in DOE Policy 450.4, *Safety Management System Policy*, as five core safety management functions and seven guiding management principles. These functions and principles are to be applied universally and systematically in the management of all hazardous activities, large or small, with control measures tailored to the specific hazards involved. The formal structure of commitment and activities embodying the site’s or facility’s ISM is called the Integrated Safety Management System. Figure 1 depicts how the core functions and seven guiding principles are linked to form an ISM System.

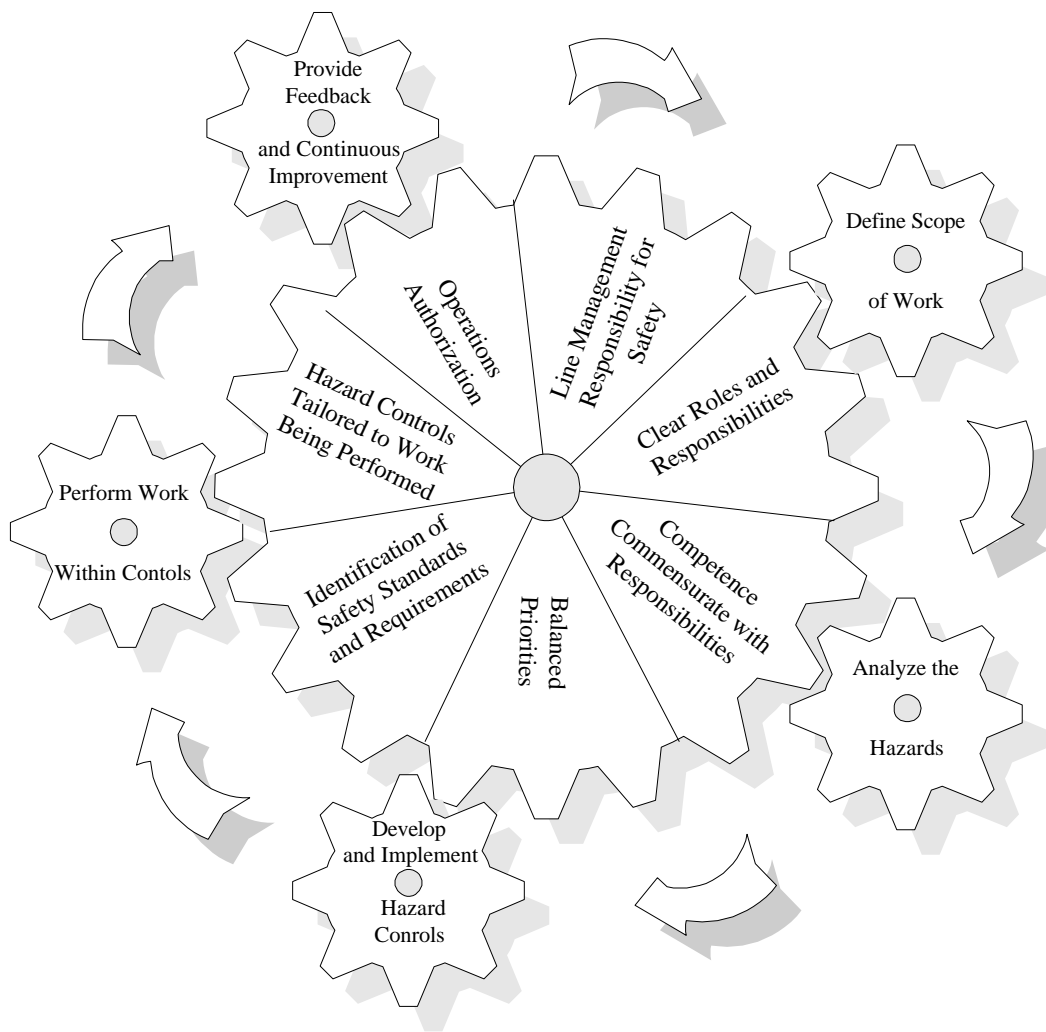


Figure 1. Integrated Safety Management: Core Functions and Guiding Principles

DOE has made substantial progress in upgrading its directives, implementing and institutionalizing ISM at facilities within the complex, and establishing a growing number of specific sets of control measures (Authorization Agreements) at major DOE sites. In 1998, the majority of DOE's institutional directives and guidance documents for ISM had been developed; thus the Board was able to shift its focus in 1999 to reviewing the implementation of DOE's guidance and the establishment of control measures for the safe conduct of work. The Board has also been stressing that doing work safely is the foremost objective of ISM. Nuclear safety is an important but not an exclusive target of ISM. Nonradioactive but hazardous materials and operations require attention at least in proportion to the risks they pose to the public, workers, and the environment. As implementation of ISM progresses, the Board will continue to assess how DOE addresses all hazards associated with its work, how DOE uses contracting mechanisms to hold the operating contractors accountable for ISM implementation, and how DOE uses performance measures to evaluate and improve ISM effectiveness.

2.2.1 Complex-wide Upgrades to Integrated Safety Management

The Board has been following closely DOE's implementation of ISM. Implementation was initially focused on 53 facilities and activities involving the most significant nuclear hazards. DOE has subsequently expanded ISM to all of its work.

In 1999 Secretary Richardson reaffirmed his commitment to implementing ISM by adopting a number of safety enhancements. These included stronger accountability through contracts; timely resolution of safety deficiencies; establishment of a Secretarial Safety Council; and the expectation that all sites, not just those under the Board's jurisdiction, will implement ISM by September 2000.

As DOE has institutionalized and implemented ISM, the Board has provided significant technical oversight. The Board has held 12 public meetings in which DOE has presented the status of its implementation of Recommendation 95-2. In addition, the Board and its staff have conducted numerous reviews of the implementation of ISM Systems at defense nuclear facilities at every major site. The Board's staff has been present during every review conducted by DOE to verify the efficacy and implementation of the ISM Systems at the sites. In addition, the staff has reviewed and commented on each major ISM document (e.g., Functions, Responsibilities, and Authorities Manual [FRAM], ISM Guide, and Department of Energy Acquisition Regulations [DEAR] clauses).

The Board's oversight has progressed through three phases. In the first phase, the Board worked with DOE to develop the necessary guidance documents for implementing ISM. These documents continue to be revised as lessons are learned from ISM implementation. In the second phase, the Board has focused on ISM implementation at the sites. The Board is now shifting its focus to confirming that the implemented ISM Systems are effective, that DOE is performing its functions and responsibilities as assigned in the FRAM, and that DOE's contractors are held accountable for completing their work within agreed-upon safety constraints.

In 1999, the Board found that sites were beginning to show improvements in safety and efficiency as DOE's contractors began to apply ISM to the work at defense nuclear facilities. Upper-level management of both DOE and its contractors has remained highly supportive and proactive. The progress of implementation is more advanced at some sites than at others; the sites with multiple contractors are experiencing the most problems in achieving site-wide consistency in the application of ISM concepts.

Several key indicators for gauging progress in the implementation of ISM have been identified as a result of the Board's reviews. These indicators are reviewed in the following subsections.

Department of Energy Acquisition Regulations Clauses

The first key indicator of progress in ISM implementation is incorporation of the ISM-related DEAR clauses in contracts. As the Board urged in Recommendation 95-2, DOE

published two DEAR clauses related to ISM (48 CFR § 970.5204-2, *Integration of Environment, Safety, and Health into Work Planning and Execution*, and 48 CFR § 970.5204-78, *Laws, Regulations, and DOE Directives*). In April 1999, DOE published an additional DEAR clause (48 CFR § 970.5204-86, *Conditional Payment of Fee, Profit, or Incentives*). A key element of this clause ties payment of contractor fees directly to meeting specific ISM performance measures. Because the rigor of the performance measures developed by the contracting officer is critical to the effectiveness of this clause, the Board will closely follow DOE's development of guidance for contracting officers and monitor field implementation. The Board views these clauses as critical to the long-term improvement of ISM programs, and as an important reinforcement of DOE's commitment to safety management.

Selection of Contractual Environment, Safety, and Health Requirements

The second indicator is the progress being made by DOE and its contractors in establishing a requirements base that serves as the foundation for a site-wide ISM program. Once approved by DOE, the resulting requirements become binding contract terms. During 1999, the Board ascertained that all contracts included a DOE-approved set of requirements and that each site had a process for maintaining configuration control of this set. The Board and its staff also worked with DOE to update DOE's guidance for determining or revising requirement sets to bring the process more into consonance with ISM principles.

Integrated Safety Management System Descriptions

The Board has followed the development of ISM System Description documents required by the DEAR. These documents describe how the contractor will integrate the tenets of ISM into work practices. DOE is required to review and approve each contractor's ISM System Description. DOE's approval of the document signifies its acceptance of how the contractor will manage work using the principles of ISM. The process for reviewing ISM System Descriptions and a key step in their approval is the Verification Review, which is discussed in the next subsection. In 1999, DOE approved ISM System Descriptions for Idaho National Engineering and Environmental Laboratory (INEEL), the Hanford Tank Farms, Sandia National Laboratories (SNL), Lawrence Livermore National Laboratory (LLNL) Superblock, Los Alamos National Laboratory (LANL), and Oak Ridge National Laboratory (ORNL). ISM System Descriptions were approved in 1998 for the Savannah River Site (SRS), the Y-12 Plant, the Waste Isolation Pilot Plant (WIPP), and the Rocky Flats Environmental Technology Site (RFETS). ISM System Descriptions for the Pantex Plant, the Nevada Test Site (NTS), and the Hanford Site are pending DOE approval, which is expected to occur in 2000.

ISM System Verification Reviews

In Recommendation 95-2, the Board recommended that a formal process be established for reviewing and approving contractors' safety management programs. In response to the Board's urging, DOE established a protocol for performing ISM System Verification Reviews, and in February 1998 issued the *Integrated Safety Management Systems Verification Process Team Leader's Handbook* (DOE-Handbook-XXXX-98, February 1998). This initial version of

the Handbook was revised in 1999 to address the Board's comments and to reflect additional lessons learned from the ISM System verification process.

There are two types of Verification Reviews—Phase I and Phase II. Phase I is a review of the description of the ISM System developed by the contractor in response to formal direction provided by the senior DOE manager at the site (Approval Authority) in accordance with the ISM DEAR clause. The review evaluates the adequacy of the procedures, policies, and manuals of practice used to implement ISM. The primary goal of the Phase I review is to provide a recommendation to the Approval Authority as to whether the ISM System documentation is adequate and should be approved. The purpose of the Phase II review is to evaluate whether the contractor has implemented the ISM System at the site, facility, or activity.

During 1999, the Board's staff continued its previous practice of observing and constructively critiquing all DOE Verification Reviews conducted at defense nuclear facilities. These Verification Reviews, led by senior DOE technical staff and supplemented by outside subject matter experts, have been highly beneficial to both those performing the work (contractors) and those providing the technical oversight (DOE management). These benefits accrue from an enhanced understanding of the work that results from the systematic application of the functions and principles of ISM. The results of these reviews have shown that, in general, all sites have considerable site-wide safety management infrastructures in place, but all can benefit from the capture of good practices for planning and performing hazardous work. Such upgrade efforts are under way. Since 1997, DOE has conducted 29 Verification Reviews, 19 of which covered Recommendation 95-2 priority or follow-on facilities; 6 reviews will be conducted in 2000 to complete the priority and follow-on facilities. DOE must complete almost 30 reviews in 2000 to meet Secretary Richardson's goal of implementing ISM at all facilities in the complex by September 2000.

In 1999, the Board urged DOE to examine the results of all ISM System Verification Reviews completed through 1999 for common issues and lessons learned throughout the DOE complex. A DOE team formed to review the verification reports identified commonalities in documented noteworthy practices and opportunities for improvement, and made recommendations for maintaining continuity of ISM during changes of contractors. The team's report was released to the DOE complex in October 1999, and the lessons learned are scheduled to be incorporated into the next revision of DOE-Handbook-XXXX-98.

In 2000, the Board will continue to perform a key oversight role as DOE implements and refines its ISM programs. Much work remains to ensure that the intent of Recommendation 95-2 is fulfilled. In a memorandum to the DOE complex dated October 25, 1999, the Deputy Secretary provided criteria for ISM implementation. These criteria, reviewed extensively by the Board and its staff, build on the verification process, focus on DOE's actions and implementation, and provide the minimum criteria necessary to declare that an ISM System has been implemented. A critical component of these criteria is the implementation of Authorization Agreements. The Board will work with DOE to ensure that Authorization Agreements become contractually binding agreements to ensure that work is performed safely. The Board will also focus on ensuring that the federal workforce is held accountable for performing its functions and

responsibilities as designated in the FRAM, and that DOE's contractors are held accountable for completing their work within agreed-upon safety constraints.

ISM implementation efforts to date have revealed the need to update some of the existing Safety Analysis Reports to better reflect current missions and report standards. Such reports, or their equivalents, are the underpinning of an ISM System. Documented in such reports are the potential dangers that attend the work planned, and the controls and other safety measures required to perform work safely. Such documents need to be kept current as the work changes. While the functions and principles of ISM remain constant as a management concept applicable to diversified hazardous activities, the safety control measures must be tailored to the specifics of each hazardous activity. The application of ISM functions and principles requires dynamic, ongoing analysis as a part of work planning and implementation of safety measures.

DOE has programmed updates of safety analyses for some older facilities and operations, and requires that safety analyses for new facilities under design be performed to revised standards. In 2000, the Board will continue its review of such documents.

Feedback and Improvement and Recommendation 98-1

In response to the Board's March 20, 1998, reporting requirement on DOE's feedback and improvement program, DOE committed to upgrading its lessons learned process. Improved guidance on the subject is included in the latest revision to DOE G 450.4-1A, *Integrated Safety Management Guide*, May 27, 1999. The FRAM was also updated to define more clearly the manager's role in this key area. The Secretary of Energy's March 3, 1999 memorandum on safety accountability and performance tasked the newly established DOE Safety Council with developing performance standards that will be used to hold federal personnel accountable for effective and timely ISM implementation. The Board and its staff worked closely with DOE on this activity. The Deputy Secretary of Energy's October 25, 1999, memorandum included criteria that will be incorporated into senior manager performance plans.

The Board issued Recommendation 98-1, *Integrated Safety Management*, to address the internal independent oversight element of the feedback and improvement program, which the Board believed was not being adequately addressed in DOE's feedback and improvement initiatives. The Board had determined that independent assessments by DOE-Headquarters of safety management in the field were being treated largely as advisories, and that follow-up actions by DOE's line management were discretionary. DOE accepted Recommendation 98-1 and provided an acceptable Implementation Plan that addressed DOE's need for a clearly defined, systematic, and comprehensive process to resolve safety issues identified by internal independent oversight. The Board and its staff worked closely with DOE to develop a process for addressing these safety issues, including a Web-based system for tracking the status of corrective actions. This process was institutionalized in the DOE directives system. In 2000, the Board will monitor the process to ascertain that it is fully implemented and that DOE's system for tracking corrective actions provides meaningful status reports to senior DOE managers.

Authorization Agreements

The Board continues to assign great importance to the timely execution of Authorization Agreements for high-hazard defense nuclear facilities. An Authorization Agreement is a documented agreement between DOE and a contractor that incorporates a statement of work authorized to be done and the contractor's proposed means for conducting the work safely. An Authorization Agreement includes appropriate limits on safety-related parameters and activities, and sets forth key terms and conditions under which the contractor is authorized to perform the work. Some restrictions may be identified as administrative controls, and technical requirements necessary for safety are specified as commitments, thereby making the use of certain procedures and practices contractually binding. Authorization Agreements (analogous to the licenses of commercial nuclear facilities) greatly facilitate the identification, implementation, and maintenance of safety controls needed to prevent any accidental release of radioactive materials in or from the workplace, or to mitigate the consequences of an accident should one occur.

To assist DOE and its contractors in developing Authorization Agreements, the Board issued DNFSB/TECH-19, *Authorization Agreements for Defense Nuclear Facilities and Activities* (April 1998). As a result of this and other actions, more than 100 facilities or major activities are operating within the bounds of signed Authorization Agreements. This accomplishment by DOE is a notable outcome of the ISM activity and a substantive measure of successful ISM implementation. It is particularly noteworthy that to date, Authorization Agreements for all but two of the defense nuclear facilities that merit such agreements have been approved. Table 2 provides the current status of Authorization Agreements for these 53 facilities (10 priority and 43 follow-on).

Table 2. Status of Authorization Agreements for Priority and Follow-on Facilities

Priority Facilities		AA in Place	Approval Date/Status
DEFENSE PROGRAMS			
Lawrence Livermore National Laboratory			
1	Superblock:		
	Bldg. 332, Plutonium Facility	Yes	6/97
	Bldg. 334, Weapon Design & Testing Facility	Yes	1/28/99
	Bldg. 331, Tritium Facility	Yes	1/28/99
Los Alamos National Laboratory			
2	TA-55, Bldg. 4, Plutonium Facility	Yes	1/99
3	TA-3, Bldg. 29, Chemistry and Metallurgy Research (CMR) Facility	Yes	1/99
Oak Ridge National Laboratory			
4	Y-12 Plant		
	Bldg. 9212, Wet Chemistry, Casting, Storage	Yes	5/15/98
	Bldg. 9206, Enriched Uranium Chemical Processing	No	Expected 2/00
	Bldg. 9720-5, Warehouse Operations	Yes	4/6/98
	Bldg. 9204-2E, Disassembly Operations	Yes	4/6/98
	Bldg. 9204-4, Quality Evaluation	Yes	4/6/98

**Table 2. Status of Authorization Agreements for Priority and Follow-on Facilities
(Continued)**

Follow-on Facilities		AA in Place	Approval Date/Status
	Bldg. 9215, Special Nuclear Materials (SNM) Processing & Fabrication	Yes	5/15/98
Pantex Plant			
5	Zone 12, Nuclear Explosive Bays and Nuclear Explosive Cells	No	AAs will be approved for specific weapon activities, not for the facility. See follow-on facilities list.
Hanford Site			
6	K-Basins Facility	Yes	9/24/98
7	Tank Farms	Yes	7/24/98
Rocky Flats Environmental Technology Site			
8	Bldg. 371, Plutonium Chemical Processing Facility	Yes	9/11/97
9	Bldg. 771, Plutonium Recovery Facility	Yes	12/31/97
Savannah River Site			
10	Canyons		
	F-Canyon	Yes	9/9/97
	FB-Line	Yes	9/26/97
	H-Canyon	Yes	8/1/97
	HB-Line	Yes	3/19/98
Lawrence Livermore National Laboratory			
1	Bldg. 231 Complex (Vaults)	No	Not required for Cat. 3 facilities.
2	Bldg. 251, Heavy Element Facility	No	Not required for Cat. 3 facilities.
Los Alamos National Laboratory			
3	TA-18, Pajarito Laboratory	Yes	12/99
4	TA-16, Weapons Engineering Tritium Facility	Yes	8/2/99
5	Defense Nuclear Activities at TA-15, Dual Axis Radiographic Hydrotest Facility	No	No defense nuclear work planned for this year.
6	Defense Nuclear Activities at TA-53, Los Alamos Nuclear Scattering Center	No	No defense nuclear work planned for this year.
Nevada Test Site			
7	Abel Site, Area 27 (to be replaced by the Device Assembly Facility, Area 6)	Yes	1/14/99
8	U1a Complex	Yes	1/14/99
Oak Ridge National Laboratory			
9	Material Storage (Bldg. 3019)	Yes	10/99
Pantex Plant			
10	Bldg. 12-116, SNM Staging Facility	Yes	7/98
11	Bldg. 12-104A, Special Purpose Bays (New - not operational)	No	No defense nuclear work planned in FY00.
12	Dynamic Balancer (Bldg. 12-60)	Yes	11/97

**Table 2. Status of Authorization Agreements for Priority and Follow-on Facilities
(Continued)**

Follow-on Facilities		AA in Place	Approval Date/Status
13	Weapons Programs		
	W56	Yes	2/99
	W69	Yes	7/97
	W76	No	New program. Expected 7/00
	W78	No	New program. Expected 12/00
	W79	Yes	7/98
14	Paint Bays (Bldg. 12-41)	No	No plans for AA. 12-104A will replace.
Sandia National Laboratories			
15	Sandia Pulse Reactor Facility	Yes	12/14/99
Savannah River Site			
16	Tritium Facilities		
	Tritium Inventory Storage Area (217H)	Yes	8/26/97
	Tritium Isotope Separation/Purification Facility, Lines I/II (232H)	Yes	8/26/97
	Tritium Reservoir Finishing/Packing Facility (234H)	Yes	8/26/97
	Tritium Reservoir Loading/Unloading Facility (233H)	Yes	8/26/97
	Tritium Burst Test Facility (236H)	Yes	8/26/97
	Tritium Byproduct Purification Facility (236H)	Yes	8/26/97
	Tritium Extraction Facility, Line III (232H)	Yes	8/26/97
	Tritium Reservoir Reclaiming Facility (238H)	Yes	8/26/97
	Tritium Storage/Spare Parts/Shipping (237H)	Yes	8/26/97
ENVIRONMENTAL MANAGEMENT			
Hanford Site			
17	Waste Encapsulation and Storage Facility	Yes	3/25/99
18	Plutonium Finishing Plant	Yes	8/12/99
Idaho National Engineering and Environmental Laboratory			
19	Underwater Fuel Storage (CPP-603-A)	Yes	3/31/99
20	Irradiated Fuel Storage Facility (Dry SNM Storage) (CPP-603-B)	Yes	3/31/99
21	New Waste Calcining Facility (CPP-659)	Yes	3/31/99
22	Underwater Fuel Storage Facility (CPP-666)	Yes	3/31/99
23	Radioactive Waste Management Complex	Yes	3/31/99
24	Unirradiated Fuel Storage Facility (CPP-651)	Yes	3/31/99
Nevada Test Site			
25	Radioactive Waste Management Sites in Area 5, Area 3, and the TRU Pad	Yes	1/14/99
Oak Ridge National Laboratory			
26	K-25 (East Tennessee Technology Park) highly enriched uranium (HEU) Remediation Deactivation		
27	Depleted Uranium Tailings Facility	Yes	11/30/98
28	Material Storage (Molten Salt Reactor Experiment)	No	Expected 12/00

**Table 2. Status of Authorization Agreements for Priority and Follow-on Facilities
(Concluded)**

Follow-on Facilities		AA in Place	Approval Date/Status
Rocky Flats Environmental Technology Site			
29	Bldg. 707, Plutonium Manufacturing Bldg.	Yes	8/15/97
30	Bldg. 776, Manufacturing Bldg.	Yes	8/25/99
31	Bldg. 559, Analysis Laboratory	Yes	3/17/98
32	Bldg. 774, Waste Processing	Yes	8/31/99
Savannah River Site			
33	FA-Line	No	No plans to operate.
34	HA-Line	Yes	Covered in H-Canyon AA.
35	235-F	Yes	12/15/98
36	Defense Waste Processing Facility	Yes	10/6/97
37	In-Tank Precipitation/Extended Sludge Processing	Yes	7/16/98
38	High Level Waste Storage Tanks	Yes	3/9/98
39	Receiving Basin for Offsite Fuel	Yes	9/17/97
40	K-Reactor Basin	Yes	9/17/97
41	L-Reactor Basin	Yes	9/17/97
WIPP			
42	Waste Isolation Pilot Plant	Yes	4/21/99
NUCLEAR ENERGY			
Idaho National Engineering and Environmental Laboratory			
43	Advanced Test Reactor	Yes	4/9/99

The Board's reviews revealed that the Authorization Agreements varied in quality and completeness. The Board therefore urged DOE to conduct its own review of Authorization Agreements for defense nuclear facilities. Two teams performed independent reviews of all the approved Authorization Agreements. These reviews confirmed the findings of the Board, and resulted in more than 15 suggestions for improving Authorization Agreements, including updating guidance in DOE G 450.4-1A and the roles and responsibilities for Authorization Agreements in the FRAM. DOE provided the results and lessons learned from these reviews of Authorization Agreements to the entire DOE complex.

2.2.2 Site/Facility-Specific Upgrades

As noted, Secretary Richardson has tasked the complex with having ISM Systems in place by September 2000. Although the key indicators discussed in the previous section reveal that DOE is making progress in implementing ISM, there still is a need to review the quality and effectiveness of the application of ISM functions and principles to specific hazardous work. The Board and its staff have focused considerable resources on determining whether the requirements established in each contract are reflected in safety management processes or implementing procedures used in specific work activities covered by the site's ISM System. The staff has also continued to review the adequacy of facilities' ISM System implementation. In general, the

Board has observed that many sites are finding that the implementation of ISM at the facility and individual hazardous-task levels often requires the changing of old habits. Embedding this new safety culture in the workplace is proving to be more involved and complex than the sites had expected. However, most sites have in place at least the basic elements of an acceptable ISM System. More work remains to be done to embed the functions and principles of ISM deeply into the planning and execution of work at all levels of an organization, thereby achieving the goal of enhanced safety for the public, workers, and the environment. The following subsections describe the progress on ISM upgrades at each site.

Y-12 Plant, Tennessee

In 1998, DOE conducted a combined Phase I and Phase II Verification Review of the ISM System at the Y-12 Plant. While the verification team recommended approval of the Y-12 ISM System Description, it noted that the ISM System was in the early stages of implementation. Therefore, the team concluded that additional focused management attention would be required to ensure the mature and consistent implementation of the ISM System. During 1999, the contractor continued to work on implementing a mature ISM System and helped sponsor various ISM System workshops held across the complex, including a workshop on worker protection that was conducted in Knoxville, Tennessee, in November 1999.

In August 1999, without prompting from DOE, the contractor conducted a self-assessment of ISM System implementation—the first of its annual ISM System reviews as required by the DEAR clause. The assessment team noted strengths in the implementation of an ISM System in the Special Materials Organization and the H-1 Foundry, but also noted weaknesses in such areas as performance indicators and maintenance work control processes. In addition, the team noted that a reduction in force was being implemented site-wide during the performance of the assessment, and that while its potential impact on ISM work control processes could not be evaluated by the team, the staff responsible for issues management and lessons learned programs has been virtually eliminated.

Several mishaps experienced at Y-12 late in 1999 dramatically underscored the need to enhance work planning/safety planning at the activity level in accordance with the functions and principles of ISM if the safety of workers is to be ensured. These incidents involved (1) inadequate quality control of welds in piping for hydrogen fluoride (a highly hazardous gas), and (2) a lithium fire and explosion in a casting process involving sodium-potassium as a coolant. This Y-12 experience emphasizes the absolute necessity of bringing safety planning and execution to the workplace if the objectives of ISM are to be achieved. A well-conceived paper description is simply not enough. The Board will be working with DOE to improve the Y-12 safety management program.

Pantex Plant, Texas

The Board's staff observed the conduct of ISM System Verification Reviews by DOE at Pantex initially in September 1998. The DOE team concluded at that time that the processes for executing safety management functions for the Pantex mission of nuclear explosive operations required further definition in the ISM System Description and implementing documentation.

Improvements were needed in the flowdown from safety requirements to plant directives, standards, and manuals. In addition, the team identified inconsistent execution of ISM functions for nuclear explosive operations. The DOE verification team recommended that DOE and the contractor complete their ongoing action to formally define the processes unique to nuclear explosive operations that would provide an evolved system of safety management, and that the ISM System Verification Reviews be repeated for the nuclear explosive mission area after an appropriate implementation period.

In 1999, DOE made progress in clarifying the roles and responsibilities of DOE, the Pantex contractor, and the nuclear weapons design laboratories with regard to ISM System implementation. DOE also made substantial progress in defining a system for conducting the core functions of ISM at Pantex in a manner that is more consistent with the approach taken at other DOE defense nuclear facilities. These improvements in ISM System definition were codified in a supplemental directive issued by DOE's Albuquerque Operations Office. This progress notwithstanding, DOE and its contractor have not yet completed site-wide implementation of an ISM System at the Pantex Plant. The application of ISM functions and principles for two of the major missions at Pantex—high explosives fabrication and nuclear material storage—was considered adequate during the initial DOE reviews. Substantial work is still required in the third mission area—nuclear explosive operations.

Pantex's progress in 1999 with respect to implementing the refined ISM System has been slow and difficult. The program has been disappointing, in view of the Board's additional emphasis on implementation of ISM. In its Recommendation 98-2, *Safety Management at the Pantex Plant*, the Board urged DOE to take fundamental actions to improve the safety of all weapons-related work at the Pantex Plant. Foremost among the Board's specific recommendations was that DOE increase the formality of the processes designed to ensure the safety of activities at Pantex so that resultant safety improvements will be expedited and accelerated. DOE accepted Recommendation 98-2 and made specific commitments to improve safety management at Pantex, including accelerated efforts to establish weapon-specific safety bases for all ongoing activities at the plant.

Implementation of the requirements of the new process has not been observed during nuclear explosive activities. Pantex has continued to rely on less efficient and less integrated programs to start up each new activity. This approach requires extensive oversight and reviews to ensure that adequate controls are developed and implemented for safe operations. In addition, the progress that has been made has occurred at a disappointingly slow pace. As a result of this slow progress in executing core ISM functions for nuclear explosive activities, the follow-on Phase I and Phase II ISM System Verification Reviews for the nuclear weapons mission area at Pantex have slipped to late FY 2000.

Los Alamos National Laboratory, New Mexico

The current contract between DOE and the University of California for managing LANL became effective October 1, 1997. LANL and the University identified an initial set of safety standards and requirements to which the University and DOE agreed contractually. The Work Smart Standards process has been defined to keep the set current. For example, requirements

from DOE Order 440.1A on suspect and counterfeit items have now been incorporated into the contract.

The Board has been encouraged by LANL's demonstrated commitment to ISM and the soundness of its approach to ISM implementation. DOE performed a combined Phase I and II Verification Review of the laboratory's site-wide ISM System during October 12–22, 1999. Preliminary results indicate that the LANL system requires further development. The verification teams recommended that the ISM System Description be approved while noting some comments. However, the teams identified the need to address (1) requirements and expectations for identifying, analyzing, and categorizing hazards at the facility level;

(2) procedures to describe the expectations for authorization bases for nuclear and non-nuclear facilities; and (3) improvements in feedback and improvement programs to ensure continuous improvement of the ISM System. Reverification or outside review will be necessary after corrective actions have been completed.

DOE's Los Alamos Area Office (LAAO) was not found ready for its administration of ISM. The teams identified the need for processes and procedures to effectively carry out ISM responsibilities in accordance with the FRAMs of both DOE and the DOE Albuquerque Operations Office. LAAO will require reverification or outside review after completion of corrective action. Finally, a commitment was made by DOE's Albuquerque Operations Office to conduct an ISM System review of its interfaces with its area offices and the work conducted by their respective contractors. This review is tentatively planned for June 2000.

Lawrence Livermore National Laboratory, California

LLNL has long had a safety management program based upon safety requirements specified by rules and contract terms. The laboratory's health and safety manual and its environmental compliance manual reflect these requirements. Early in the Board's oversight of LLNL's weapons-related activities, the Board and its staff noted that there was no formal requirement to use these manuals for planning and performing work, nor was there a clear correlation between the work practices and procedures and the safety requirements specified by contract. Early attempts by LLNL to address what appeared to be significant shortcomings revealed the need to better select for specification by contract those generally applicable DOE requirements most suitable for laboratory-type activities and the research environment. The laboratory was challenged by the Board to do so. As LLNL undertook this challenge, the Board and DOE developed the concept of ISM, which can be universally applied to integrated work planning and safety planning and tailored to any potentially hazardous activity.

While continuing to operate nuclear facilities under its current contractual safety requirements, LLNL has been making the transition from the existing management programs to the ISM framework, tailoring these programs to best fit the laboratory environment. During the past year, this development was focused on the resumption of nuclear operations in the Superblock facilities after a systematic reassessment of all hazardous activities had been conducted, and the adequacy of safety measures had been assessed. Improved practices for planning, authorizing, and controlling work safely were developed. The Plutonium Facility has implemented these practices, while the Tritium Facility and Hardened Engineering Test Building

are beginning to do so. More systematic improvements in areas such as Authorization Basis development and conduct of Unreviewed Safety Question determinations continue as part of the laboratory-wide improvement effort.

The ISM System Verification Review for the Superblock was completed in September 1999. Although several areas for improvement were identified, the Superblock ISM System Description was acceptable, and implementation of ISM was evident. Additionally, DOE's Livermore Site Office developed an organization and system for the performance of safety oversight at LLNL.

Sandia National Laboratories, New Mexico

The Board's staff continued to assess improvements in safety management at SNL, including the Sandia Pulsed Reactor Facility. In October and November 1998, the Board's staff observed DOE's combined Phase I and Phase II ISM System Verification Review for the SNL site. DOE found that the ISM System Description for the site had not been fully developed. SNL and the DOE-Kirtland Area Office developed a corrective action plan to remedy deficiencies found during the ISM System Verification Review, and appear to be making satisfactory progress on that plan.

Savannah River Site, South Carolina

Westinghouse Savannah River Company (WSRC) largely completed implementation of its ISM System in 1998. Authorization Agreements for the priority and follow-on defense nuclear facilities at SRS are now in place. The WSRC Facility Evaluation Board has demonstrated its capability to perform an adequate continuing review of ISM principles. WSRC and DOE's Savannah River Operations Office (DOE-SR) deserve considerable credit for their success in this endeavor. In March 1999, the Board's staff observed an ISM System Verification Review of the site security contractor; no significant deficiencies were noted.

ISM System Verification Reviews for most SRS facilities have been completed, and Authorization Agreements with DOE-SR have been signed. In site reviews by the Board's staff and a summer 1999 review by ES&H, some areas for improvement in safety management were identified. The needed improvements fall into three main categories: (1) safe performance of work at the activity/task level, (2) identification and analysis of hazards, and (3) identification and implementation of controls to address those hazards. Specific weaknesses were noted in prejob planning; excessive use of administrative controls rather than those based on proper use of equipment; and integrated hazard analyses that address all hazards, including chemical and radiological hazards.

Rocky Flats Environmental Technology Site, Colorado

ISM at RFETS is implemented as a site-wide process, with the primary focus being on individual work activities. In 1999, the Board's staff assessed preparations for and conduct of several decommissioning activities at the site. These assessments revealed that RFETS's approach to planning and controlling work is improving. However, deficiencies in

implementation of the core functions of ISM were identified in some of the individual work activities assessed. Guidance for control of work and for the development of safety controls and work procedures has recently been consolidated in a single work control document. RFETS continues to improve this guidance. While this should ultimately improve work control at the site, some of the cognizant personnel do not fully understand their roles and responsibilities for implementation of the process in the field. The Board has encouraged the site to provide training to better implement the work control process and to clarify the responsibilities of the appropriate personnel. While individual work planning efforts could be improved, the Board believes overall implementation of ISM at RFETS has generally been satisfactory. Many of the attributes of RFETS's work control program are appropriate for implementation at other sites performing similar work. The Board has encouraged DOE to promulgate the lessons learned at RFETS to the rest of the defense nuclear facilities complex.

Hanford Site, Washington

Because of a recent decision to reorganize the Project Hanford Management Contractor, Fluor Hanford (formerly Fluor Daniel Hanford), from a management and integration organization to a new project-focused organization, the final verification and approval of the Fluor Hanford ISM System Description has been delayed. In October 1999, DOE conducted a Phase I Verification Review of Fluor Hanford, generating a specific recommendation that approval of the ISM System Description be deferred until further restructuring has been completed. Further, the new ISM System Description is to be made consistent with the new organization, and Fluor Hanford is to continue to update its policies, procedures, and manuals of practice to conform to its new organization and project focus. During the past year, the Board observed the Verification Reviews undertaken to validate the status of ISM System implementation for the Tank Farms (Phase II) and Spent Nuclear Fuel Project (SNFP) (Phases I and II). Both of these reviews showed an acceptable application of ISM. DOE has scheduled additional Verification Reviews for the remaining activities at the Hanford Site to support complete ISM System implementation by September 2000.

The Board has continued to review the status of ISM implementation in work control systems within the Tank Waste Remediation System (TWRS), SNFP, and the decommissioning of nuclear facilities by Bechtel Hanford Incorporated (BHI). The Board has prompted DOE to make improvements in hazard analysis and development of controls, particularly within BHI.

Waste Isolation Pilot Plant, New Mexico

The Board and its staff closely followed events leading to the opening of WIPP in March 1999. In 1998, the Board's staff had observed the ISM System Verification Review for WIPP. The results of these reviews indicate that ISM System implementation at WIPP is adequate. DOE's Carlsbad Area Office issued an Authorization Agreement on April 21, 1999. However, that agreement covered only the receipt of nonmixed (i.e., non-chemically-hazardous) transuranic waste at WIPP. Following issuance of the Resource Conservation and Recovery Act (RCRA) permit by the New Mexico Environment Department in October 1999, DOE initiated litigation over disputed provisions in the permit. Once the disputed provisions have been

resolved, the Authorization Agreement may need to be revised to address the RCRA permit requirements.

Idaho National Engineering and Environmental Laboratory, Idaho

The Board has been actively involved in INEEL's development of an ISM System. INEEL has made substantial progress in this regard. The site has placed great emphasis on the importance of worker involvement in the success of ISM. The DOE Idaho Operations Office incorporated worker involvement as an eighth guiding principle for ISM, confirming its commitment to the workers. A second key to their progress was the establishment of an ISM project office to coordinate all of the activities for ISM System development and implementation. The ISM project office's use of project management tools for this task was a noteworthy practice. In April 1999, INEEL successfully completed a Phase I ISM System Verification Review, and the site manager approved the ISM System Description. Lockheed Martin Idaho Technologies Company was the management and operating (M&O) contractor during the Phase I Verification Review.

Because of the variety and complexity of operations at INEEL, five representative facilities were selected to demonstrate the implementation of an ISM System during the Phase II Verification Review held in September 1999: the Advanced Test Reactor, the Radioactive Waste Management Complex, the Waste Experimental Reduction Facility, the Transportation Complex, and the Idaho Research Center. ISM System implementation was successfully demonstrated at four of the five facilities, the exception being the Radioactive Waste Management Complex, which failed in one area—execution of written procedures—that was subsequently corrected and will be verified in March 2000. That facility has the challenge of shipping 3,100 cubic meters of transuranic waste to WIPP during the next 3 years. It was observed consistently during the review that managers and workers were appropriately involved; teamwork was pervasive; and prioritization, scheduling, and allocation of resources were being accomplished effectively to manage the work.

A major challenge that faced INEEL in 1999 was the transition to a new M&O contractor, Bechtel BWXT Idaho, LLC, which became effective October 1, 1999. Key to this transition was the commitment by the new contractor to use the existing ISM System Description. An ISM System must be effectively implemented at the Idaho Nuclear Technology Engineering Center (INTEC), formerly the Idaho Chemical Processing Plant, by March 2000. INTEC presents the greatest technical and managerial challenge to DOE at INEEL because of the need to process 1.4 million gallons of radioactive liquid waste remaining from the reprocessing of spent nuclear fuel, store spent fuel (currently in wet pool storage) until it can be shipped to a national repository, stabilize high-level waste calcine and ship it to a national repository, and clean up many buildings associated with fuel and waste processing. The Board will closely follow ISM System implementation at INTEC. The remainder of the INEEL site is to have an ISM System in place by September 2000, consistent with the Secretary of Energy's commitment.

Oak Ridge National Laboratory, Tennessee

The ORNL ISM System Description consists of a corporate-level description, manuals of practice, and 35 division- or facility-specific ISM System program plans. The Board and its staff have focused on ISM System implementation for two of these activities—the deactivation and cleanup of the Molten Salt Reactor Experiment and U-233 storage operations in Building 3019. In April 1999, DOE conducted a Phase I ISM System Verification Review, emphasizing Building 3019 operations. The verification team recommended that the DOE Approval Authority give final approval to the ISM System Description and implementing documents, with a few modifications to the corporate-level program description. The Board was encouraged by the commitment of ORNL's upper management to ISM. This commitment was further demonstrated in October 1999 when DOE formally implemented an Authorization Agreement for operations in Building 3019. However, the Board's staff and other DOE review teams have noted the need for improvement in the ORNL contractor's conduct of operations, which is inhibiting the pace of ISM System implementation. Improving ISM System implementation and conduct of operations is critical at Building 3019 if ORNL is to implement the U-233 inspection program successfully. The Board and its staff will continue to focus attention on this area in 2000.

Nevada Test Site, Nevada

DOE faces a unique challenge in tailoring a safety management program based on the functions and principles of ISM for operations at NTS because these operations are conducted and managed by national laboratory personnel who are not under contract to DOE's Nevada Operations Office (DOE-NV). This situation makes it difficult for DOE-NV to enter into contractually binding agreements with the laboratories regarding safety expectations. Partly as a result of the complex nature of NTS's operations, DOE has not made substantial progress during the past year in finalizing a site-wide approach to ISM. Concerned that NTS would be unable to meet the Secretary of Energy's commitment to fully implement ISM by the end of FY 2000, the Board sent DOE a letter dated October 5, 1999, asking that heightened urgency be communicated to DOE-NV and the national laboratories to ensure that ISM is implemented in a timely manner.

This situation is mitigated by the fact that the hazardous activities currently conducted by the laboratories at NTS are discrete and relatively infrequent, facilitating their control through an activity-specific ISM approach. A review of this approach by the Board and its staff during assessments of the Device Assembly Facility (DAF) and individual subcritical experiment operations revealed that these operations have been conducted in accordance with DOE-NV Orders that reflect the functions and principles of ISM.

2.2.3 Cross-Cutting Issues

A number of additional initiatives by the Board have further encouraged DOE to focus consistently on implementing and institutionalizing ISM in all phases of the life cycle: design and construction, startup, operation, and decommissioning. Examples of these initiatives are described in the following subsections.

Software Quality Assurance

The Board places strong emphasis on establishing and maintaining the validity and proper application of analytical tools that are used to determine the possible effects of hazards to health and safety, and the effectiveness of features of the facility that could mitigate any harmful consequences. Software quality assurance (SQA) is a process for the systematic development, testing, documentation, maintenance, and execution of software. During 1999, the Board reviewed the status of SQA for safety-related software used by DOE, including that used to develop information for decisions on safety-related design and software programs used to control safety-related systems. Significant SQA deficiencies were identified in both types of software.

According to recently released studies, fewer than 4 percent of computer codes relied upon for the safety bases of DOE's facilities meet current industry standards for SQA. This situation is of significant concern because the use of software of poor pedigree has the potential to severely degrade the safety bases. Furthermore, numerous problems regarding the correct execution of safety analysis codes have been identified, indicating a lack of adequate guidance and training in this area.

The Board has also determined that nominal SQA requirements for instrumentation and control (I&C) software, where they exist, often do not flow down to the level of implementation for specific control systems. Although most software-controlled systems have hard-wired safety systems, the associated I&C software continues to play a defense-in-depth role. Therefore, SQA deficiencies in I&C software degrade I&C integrity and decrease the overall safety margin for these systems.

The Software Quality Assurance Working Group within DOE has been cognizant of some of these issues since February 1999, and DOE has been aware of potential SQA problems ever since the beginning of reliance on computers for storage, processing, and use of data. Specific problems in certain safety areas have been recognized for at least a decade. However, little progress has been made in addressing these problems because no senior DOE leader has actively accepted responsibility for the SQA function.

The Board believes these problems are symptomatic of underlying deficiencies in the infrastructure supporting SQA at DOE, and that the lack of a sound SQA infrastructure can be inimical to safety at DOE-owned defense nuclear facilities. The Board intends to follow DOE's resolution of this issue.²

Welding Quality Assurance

A viable quality assurance program is key to preserving the desired conservatism in robust safety system design during fabrication and installation of systems, design, and

² The Board issued a technical report, *Quality Assurance for Safety-Related Software at Department of Energy Defense Nuclear Facilities*, DNFSB/TECH-25, on January 20, 2000. The Board's forwarding letter called on DOE to provide a report within 60 days addressing the identified deficiencies and setting forth a plan and schedule for corrective action.

construction. The Board has observed several incidents that indicate a breakdown in weld quality assurance within DOE. In some cases, components and piping that had passed all required inspections were about to be put into service when, purely by chance, defective welds were discovered. Although in these specific cases the welds were repaired or evaluated for the intended service and accepted with the defects, these incidents raise a larger concern. The clear breakdown in weld quality assurance could have allowed components with defective welds to be placed into service in systems where weld failure could injure workers, adversely affect public health and safety, or result in contamination of the environment. The Board requested that DOE review these incidents and develop a corrective action plan for preventing their recurrence.

Confinement Ventilation Systems

Confinement ventilation systems are important safety features of DOE facilities in which hazardous materials are handled in dispersible form. High-efficiency particulate air (HEPA) filters are critical elements of these confinement systems. They are the final physical barrier to the release of material to the atmosphere and thereby serve to protect the public, workers, and the environment. For many years, an informal but highly effective nationwide infrastructure supported production of and quality assurance for HEPA filters for safety-related service in a variety of hazardous operations, including those conducted in DOE facilities. Today there is convincing evidence that this infrastructure is failing.

In May 1999, the Board published DNFSB/TECH-23, *HEPA Filters Used in the Department of Energy's Hazardous Facilities*. The report chronicled a number of potentially significant weaknesses in the maintenance and operation of these systems, particularly in the procurement, application, and use of HEPA filters. These weaknesses support the conclusion that confinement ventilation systems at some DOE facilities may be vulnerable to failure when they are most needed. In its forwarding letter, the Board called on DOE to provide a report addressing the weaknesses identified in DNFSB/TECH-23. DOE provided a partial response on December 6, 1999, and at year's end was developing a supplemental report.

2.3 REVIEW OF DEPARTMENT OF ENERGY DIRECTIVES

In its enabling statute, Congress directed the Board to review and evaluate the content and implementation of standards related to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities, and to recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The following subsections present examples of the Board's actions in helping DOE develop appropriate and operationally meaningful safety standards, and in ensuring the incorporation of these standards into clear and consistent requirements for DOE management and contractors.

2.3.1 Requirements and Directives

Regulations

Nuclear Safety Rulemaking. DOE has proposed to promulgate through rulemaking some of its nuclear safety requirements now included in Orders and in contract terms and conditions, thus bringing them under enforcement provisions of the Price-Anderson Amendments Act. DOE published the proposed rules in 1991 and 1995, and renewed the effort in 1999. Because of the protracted period required for the development of new drafts and the changes made to earlier versions, DOE is considering issuing the rules as interim final rules to provide further opportunity for public comment. The Board will review and comment on any new nuclear safety regulations. To date, the Board has counseled DOE to ensure that the rulemaking does not impede the ongoing ISM upgrade program, and to integrate regulatory enforcement of the new nuclear safety requirements with contract enforcement programs recently published in the DEAR.

Directives Associated with Revision of 10 CFR Part 835. In November 1998, DOE published an amendment to 10 CFR Part 835, *Occupational Radiation Protection*. DOE revised or developed the following directives in support of the amended rule or as a result of periodic review and update:

- ! DOE Guide 441.1-1, *Radiation Protection Programs*
- ! DOE Guide 441.1-2, *ALARA Program*
- ! DOE Guide 441.1-3, *Internal Dosimetry Program*
- ! DOE Guide 441.1-4, *External Dosimetry Program*
- ! DOE Guide 441.1-5, *Radiation Generating Devices*
- ! DOE Guide 441.1-6, *Evaluation and Control of Radiation Dose to Embryo/Fetus*
- ! DOE Guide 441.1-7, *Instrument Calibration for Portable Survey Instruments*
- ! DOE Guide 441.1-8, *Air Monitoring*
- ! DOE Guide 441.1-9, *Radioactive Contamination Control and Measurement*
- ! DOE Guide 441.1-10, *Posting and Labeling*
- ! DOE Guide 441.1-11, *Occupational Radiation Protection Record Keeping and Reporting*
- ! DOE Guide 441.1-12, *Radiation Safety Training*

- ! DOE Guide 441.1-13, *Sealed Radioactive Source Accountability and Control*
- ! DOE Handbook 1131-98, *General Employee Radiological Training*
- ! DOE Handbook 1130-98, *Radiological Worker Training*
- ! DOE Handbook 1122-99, *Radiological Control Technician Training*
- ! DOE Standard 1111-98, *DOE Laboratory Accreditation Program Administration*
- ! DOE Standard 1098-99, *Radiological Control Standard*

The Board's staff reviewed and commented on draft implementation guides and selected technical standards, handbooks, and training materials. Implementation guides and selected handbooks and standards were completed in FY 1999. As a result of improvements generated through review and in part because of repeated interaction by the Board's staff with DOE, guidance in support of this important safety management function was clarified and strengthened to provide more effective tools for the protection of workers.

DOE Safety Orders

Deactivation and Decommissioning Directives Associated with the *Life Cycle Asset Management Order*. DOE Order 430.1A, *Life Cycle Asset Management*, was issued in October 1998. In January 1999, the Board's staff initiated its review of three guides (DOE G 430.1-2, *Surveillance and Maintenance During Facility Disposition*; DOE G 430.1-3, *Deactivation Implementation Guide*; and DOE G 430.1-4, *Decommissioning Implementation Guide*) associated with newly developed requirements of DOE 430.1A for disposition of facilities. Throughout most of 1999, the Board's staff provided comments on the initial drafts and subsequent revisions of these guides, and frequently met with DOE's staff. The three guides were issued in September 1999, incorporating improvements resulting from the participation of the Board's staff. These improvements in health and safety guidance included an adequate description of the process for developing decommissioning end-points, specific reference to acceptable methods for developing deactivation end-points, and improvements in the rigor of surveillance and maintenance.

In October 1999, DOE provided draft DOE G 430.1-5, *Transition Implementation Guide*, to the Board for review. The Board's staff reviewed this draft, met with DOE staff, and provided preliminary comments. Review and comments are expected to continue into 2000 as this draft document is revised by DOE to incorporate changes such as those responding to comments from the Board's staff and from DOE's internal reviewers.

Manuals

DOE Manual 411.1-1A, *Safety Functions, Responsibilities and Authorities*. The Level 1 FRAM was revised during 1999 to address the Board's comments, including the need for subtier documents (Headquarters and field offices) to incorporate the health and safety

responsibilities of DOE personnel in applicable DOE Orders. In addition, DOE's organizational changes and additional responsibilities developed in response to the Board's Recommendation 98-1 were incorporated. Comments furnished by the Board's staff were also addressed by DOE, and the FRAM was issued in October 1999.

Other Directives

Directives Associated with Recommendation 98-1. To institutionalize the process for addressing safety issues identified by DOE's Office of Oversight, DOE revised the Quality Assurance Order and the FRAM. This guidance articulates the process for developing and approving corrective action plans and the roles and responsibilities of the federal managers responsible for these actions. The Board's staff provided comments on earlier drafts and believes that the guidance adequately addresses the intent of the deliverable in Recommendation 98-1. The handbook, intended to be used by field personnel in verifying compliance with ISM, was accepted by the Board in August 1999.

2.3.2 Guidance Directives

Guides

Safety Management Guide. During 1997, DOE issued DOE Guide 450.4-1, *Integrated Safety Management Guide*, which was developed largely as a result of DOE's initial experience in implementing ISM at priority facilities. The guide was developed to assist DOE contractors in describing and implementing ISM. It also provided guidance to DOE line managers tasked with oversight of contractors' ISM programs. Updating the guide is a continuing process that benefits from the additional experience gained from implementation of ISM across the DOE complex. The guide was revised in 1999 to incorporate lessons learned from implementing ISM, new DOE organizational changes, and changes made to feedback and improvement programs in response to the Board's oversight in this area. The Board has continued to work with DOE in the updating effort by reviewing the revisions to ensure that the document continues to be effective and comprehensive.

Handbooks

During 1999, members of the Board's staff met with counterparts at DOE to review drafts of the Work Smart Standards handbook for site contracts that include topics DOE committed to addressing in the Board's June 24, 1998, public meeting. These topics included the following:

- ! Legislation, statutes, rules, and regulations pertinent to implementation of the Necessary and Sufficient process and ISM,
- ! DOE policies and directives,
- ! Background and source of the Necessary and Sufficient Closure process in ISM,

- ! Expectations and explanations for the implementation of the Necessary and Sufficient Closure process,
- ! Documentation of experience with the Necessary and Sufficient Closure process, including feedback and lessons learned in question-and-answer format, and
- ! Sources of assistance.

DOE Technical Standards

Appendix A of DOE-STD-3009-94 and the Implementation Guide for DOE Order 420.1. Individuals from DOE and the Board's staff interacted throughout 1999 on the appropriate use of dose evaluation guidelines for the classification of safety-related structures, systems, and components, as presented in draft DOE Guide 420.1-X, *Implementation Guide for Non-Reactor Nuclear Safety Design Criteria and Explosives*. At the urging of the Board's staff, DOE revised the guide and proposed a new appendix to DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Non-Reactor Nuclear Facility Safety Analysis Reports*, to ensure that the evaluation guidelines would not be considered as acceptance criteria by the field, that expected doses from postulated accidents would be much lower than the evaluation guidelines, and that this guidance would be used properly by the field. In a letter to DOE dated July 8, 1999, the Board accepted this approach and provided additional comments relating to the classification of items as safety-significant to protect facility workers. Dialogue between the staffs of the Board and DOE resulted in a consensus on the wording of the changes to these documents to resolve the Board's comments; however, DOE STD-3009-94 needs to be revised further to meet the full intent of the Board's letter.

Other Directives and Related Documents

In addition to reviewing the directives and related documents discussed elsewhere in this section, the Board's staff provided comments on 18 other DOE Orders, guides, handbooks, and manuals during 1999. These efforts resulted in improvements to the provisions related to ISM.

2.4 UPGRADING DOE'S TECHNICAL COMPETENCE

2.4.1 Implementation Status

The Board's efforts during the past 6 years have assisted in achieving demonstrable improvements in DOE's technical competence in a number of areas. As part of its revised Implementation Plan for the Board's Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*, DOE formed a panel of senior line managers to ensure successful implementation of a corporate program to recruit, develop, deploy, and retain technically capable personnel at defense nuclear facilities. The panel members performed self-assessments of the technical qualification programs at their respective sites, and upgraded their plans and procedures accordingly. In November 1999, the Board determined that the major purposes of Recommendation 93-3 had been met, and the recommendation was formally closed.

However, continued vigilance and strong technical leadership at all levels of DOE management will be required to maintain the necessary technical competence for safe and effective operation of DOE's defense nuclear facilities.

Throughout the last 6 years, as a result of intensive Board interactions aimed at having DOE upgrade its technical staff, DOE has:

- ! Obtained authority for 200 excepted service positions under the Defense Authorization Act, in addition to the 200 positions allowed under the DOE Organization Act through the end of FY 2000. This authority is being used to fill key engineering, scientific, and other technical positions.
- ! Developed customized technical qualification programs tailored to safety-related duties and enrolled approximately 1,800 federal personnel in these programs.
- ! Established a technical leadership development program designed to attract and train promising new scientists and engineers for defense nuclear facilities.
- ! Identified 251 senior technical safety managers (GS/GM-15 and Senior Executive Service) who constitute the unbroken chain in line management responsibility for safety. The background, experience, and qualifications of the incumbents for these positions were evaluated by their line management. Shortfalls in training or experience were documented, and action was taken to fill the identified gaps.
- ! Recruited, trained, and qualified 201 Facility Representatives across the DOE complex through a rigorous qualification and training program comparable to that for resident inspectors in the nuclear power industry.

The Board intends to follow closely the institutionalization of processes designed to develop and preserve key DOE technical capabilities.

2.4.2 Upgrading of Criticality Safety Expertise

During 1999, DOE continued actions to upgrade its criticality safety programs and improve the training, qualification, and retained expertise of both federal employees and contractor personnel. Two draft guides were issued: *Review Guide for Criticality Safety Evaluations* and *Guide for Nuclear Safety Engineer Training and Qualifications*. In addition, a draft standard addressing criticality safety qualification was prepared that specifically identified competency requirements expected of a federal criticality safety specialist. The Board's staff was extensively involved in the review and acceptance of these documents.

The Board's staff participated in the development and pilot presentation of a new advanced criticality safety course at the critical experiments facility at LANL. The pilot presentation of the course led to the identification of a need to improve the syllabus used in the course. The Board's staff participated actively in the development of these improvements.

A member of the Board's staff conducted a review of criticality safety requirements at RFETS, motivated by reports from operations on the floor that the requirements were so structured as to be difficult to understand or follow. This action led to measures to simplify the requirements and to structure them along more understandable lines.

The Technical Area (TA)-18 site at LANL is used for criticality research and for courses to train criticality engineers at DOE's sites, both for DOE's staff and for contractors. As a result, TA-18 is the location of a substantial amount of fissionable material, primarily highly enriched uranium. In 1999, a review was conducted of the adequacy of physical security measures to protect this material. It was concluded that very expensive upgrades of physical security would be required for the purpose, and that a study should be performed to identify other possible locations for activities that have historically been conducted at TA-18. Some possibilities being considered would involve relocating the activities at other sites, in particular NTS.

The activities now conducted at TA-18, particularly the education of criticality engineers, are considered by the Board to be vital to maintaining criticality safety at DOE's defense nuclear facilities. The need to ensure continuance of this capability is even more evident after the recent criticality accident at Tokai Mura in Japan and the subsequent public focus on criticality safety.

The Board is disturbed to note that skilled personnel suitable for instruction in a criticality course are rare and are at present largely concentrated at LANL. It is unlikely that the faculty for such a course could be assembled in the near future at another location such as NTS. The Board will continue to exercise vigilant oversight over the study now under way.

In 1999, two members of the Board made presentations at a DOE-sponsored workshop for senior criticality safety managers. Key outputs of this workshop included a plan for self-assessment of criticality safety programs and development of performance measures for these important programs. At year's end, a committee of criticality safety specialists was in the process of implementing the self-assessments called for at the workshop.

3. MANAGEMENT AND STEWARDSHIP OF THE NATION'S STOCKPILE AND NUCLEAR WEAPONS COMPONENTS

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The Board has a unique role in overseeing the safety of operations in the DOE nuclear weapons complex. These vital national security activities include assembling, disassembling, and verifying nuclear components; conducting research and experiments supporting stockpile maintenance; and providing replacement components and materials. A major thrust of the Board's oversight has been to review and assess safety management programs for these activities to ensure that they are conducted in a manner that adequately protects public health and safety.

The defense nuclear complex has changed considerably since the Board's charter members were appointed in 1989. Production of new weapon systems has stopped, and dismantlement of a large fraction of the nuclear weapons stockpile is under way. Underground testing of nuclear weapons has ended as well.

Existing nuclear weapons are likely to remain in the nation's stockpile longer than in the past, potentially much longer than their original design lifetime. It will be necessary to ensure that nuclear weapons within DOE custody remain safe. In the absence of underground nuclear testing, alternative means to confirm the safety and reliability of weapons throughout their life cycle are being developed. DOE's strategy for dealing with this challenging new mission is

embodied in its stockpile stewardship and management plan.³ This plan provides for continuation of the ongoing defense missions at eight DOE sites, and includes appropriate adjustments consistent with post-cold war national security policies.

Many of the facilities used for assembly and disassembly of nuclear weapons were constructed in the period between the late 1940s and 1960s, and are now quite old. DOE is refurbishing facilities intended for continued use; the functions of other facilities will change. DOE's plans also call for the construction of facilities with enhanced experimental capabilities at the nuclear weapons laboratories. Manufacturing capabilities at some existing plants are to be maintained, but at reduced capacity. The last tritium production reactor was closed a decade ago at SRS, and DOE has initiated a project to secure a new source of tritium, which will likely require new defense nuclear facilities at SRS. In addition, a limited capability for manufacturing components of plutonium pits is planned for a weapons laboratory.

DOE must also institute life extension programs (LEPs) for specific weapon systems. LEPs are required at the Pantex Plant and the Y-12 Plant. Accordingly, the Board posted one full-time Site Representative at the Y-12 Plant in June 1998 and added another in 1999. Two Board Site Representatives have been located at the Pantex Plant since July 1992.

3.1 STOCKPILE MANAGEMENT OF NUCLEAR WEAPONS

Stockpile management is a term used to describe the industrial aspects of maintaining the DOE nuclear weapons complex. A program of research and development has also been initiated to improve DOE's means of ensuring the safety and reliability of nuclear explosives in the absence of physical testing; this program is termed *stockpile stewardship*. Stockpile management activities at major sites with defense nuclear facilities are discussed in the following subsections.

3.1.1 Pantex Plant

The Pantex Plant, located near Amarillo, Texas, plays a central role in stockpile management. Operations at Pantex include the assembly, disassembly, dismantlement, and surveillance of nuclear weapons. Pantex also serves as an interim storage site for plutonium pits removed from retired weapons.

Recommendation 98-2, *Safety Management at the Pantex Plant*

In response to the Board's Recommendation 93-1, *Standards Utilization in Defense Nuclear Facilities*, DOE developed and began implementing an upgraded work/safety planning process, called Seamless Safety for the 21st Century (SS-21), to guide the development of safety bases, procedures, and tooling for nuclear explosive operations at the Pantex Plant. Where it has been applied, the SS-21 process has yielded excellent results by integrating work planning and

³ U.S. Department of Energy, *The Stockpile Stewardship and Maintenance Program*, Office of Defense Programs, Washington, D.C., May 1995.

safety planning for dismantlement operations. However, the process has been executed for only a few programs because of its reported complexity and labor-intensive requirements.

In 1998, the Board observed that the SS-21 process was so cumbersome that it could not be followed simultaneously for the multiple types of weapons to be dismantled or surveilled. As a result, safety improvements were being deferred, and assurance of safety had begun to suffer. The Board's Recommendation 98-2, *Safety Management at the Pantex Plant*, was issued in response to this situation. Recommendation 98-2 calls for redesign and simplification of the SS-21 process with a reemphasis on the responsibility of line management, which had suffered under the existing process. Recommendation 98-2 is not prescriptive; it proposes that DOE and the Pantex contractor—Mason & Hanger Corporation (MHC)—identify and implement the necessary improvements to the system.

The pace of progress on the part of DOE and the Pantex contractor in response to Recommendation 98-2 has been disappointing. The process has not been simplified; in fact, it may have become even more complex. Recent delays caused by this process, which continues to be cumbersome and time-consuming, have resulted in the deferment of safety improvements and a prolonged dependence on less reliable or less robust safety controls and processes.

On November 22, 1999, the Board transmitted to DOE a letter concerning safety management at the Pantex Plant. In this letter, the Board affirmed its commitment to supporting DOE in improving safety at the plant in such a manner that DOE can still meet its obligations to national defense while conducting mutually agreed-upon actions designed to ensure the safety of operations.

Specific Weapon Programs

W56 Dismantlement Program. The W56 is a retired Minuteman II warhead. The full SS-21 process was employed in the development of the W56 dismantlement operation. The Board and its staff closely reviewed preparations for this major dismantlement program, including the identification and implementation of safety controls derived from the SS-21 process. As part of this effort, the Board's staff reviewed the Hazard Analysis Report (HAR) for the W56. This review revealed relatively few issues; rather, the analysis in the HAR was found to be methodical and generally comprehensive. The HAR initially identified numerous specific controls to ensure the safety of the dismantlement operation. When the results of the HAR were analyzed, the process designers were able to improve the procedures and tooling employed. For example, lifts—which pose the potential for accidental drops that would threaten the high explosive in the weapon—have been eliminated, including crane lifts of the warhead in any configuration. In addition, the tools used in dismantlement have been designed to better protect the weapon and its components by eliminating or reducing hazards.

In conducting its review, the Board's staff questioned the way it was intended that the W56 dismantlement program identify, implement, and preserve the important controls that are relied upon to prevent inadvertent detonation of the high explosive components in the weapon. In the early drafts of the Activity-Based Controls Document, there was little to differentiate these vital controls from the many other safety controls identified for the W56 dismantlement

operation. To address this issue, DOE revised its approach and committed to clearly identifying the most important controls, defining the bases for these controls, mandating appropriate requirements to maintain the functionality of these controls, and specifying actions to be taken should a control be compromised. This effort represents a substantial improvement in DOE's management of the safety of nuclear explosive operations, since it helps preserve those controls most relied upon to prevent a high-consequence accident.

The Board's staff also observed the Nuclear Explosive Safety Study (NESS) for the W56, as well as a Readiness Assessment for the W56 that was completed in December 1998. The common purpose of these two different forms of readiness reviews by panels of experts is to assure DOE that the contractor is ready to perform work safely. The staff found briefings to the NESS to be an improvement over those of earlier studies, as they were appropriately interspersed with physical demonstrations of the dismantlement procedures by production technicians—the hands-on operators. The importance of providing such realistic demonstrations has repeatedly been noted by the Board and its staff, since doing so enables the reviewers to better associate the assessed hazards with actual operations.

In a letter to DOE dated January 15, 1999, the Board communicated a number of issues concerning safety-related controls for the W56 dismantlement operations. As a result of the Board's engagement, DOE satisfactorily addressed these issues and implemented a much more robust and effective set of controls. The W56 dismantlement program started operations in 1999.

W79 Dismantlement Program. The W79 is an artillery-fired atomic projectile. Dismantlement of the W79 began on June 3, 1998, after a year of preparations involving readiness reviews and demonstrations of the process, tooling, and equipment. In last year's Annual Report to Congress the Board observed the many difficulties encountered by DOE while readying the W79 for dismantlement. In a letter to DOE dated March 12, 1999, the Board transmitted an issue paper by the Board's staff that addressed each of the Integrated Safety Management System functions as they apply to nuclear weapons operations at the Pantex Plant. The letter also noted that the Readiness Assessment process for the W79 had eventually resulted in a safe operation, but that lessons learned needed to be incorporated, along with those provided in the Board's January 5, 1999 letter, into a more efficient and effective model for future readiness assessments.

The Board's staff conducted a review of W79 dismantlement operations in June 1999, finding no adverse safety issues. The staff also observed that the technicians were well trained, that issues encountered during the process were addressed appropriately, and that authorization basis controls were being maintained. The Board acknowledged this good progress in a letter to DOE on August 10, 1999.

W87 Life Extension Program and Disassembly and Inspection Operations. The W87 is a warhead used on the Peacekeeper missile system. Throughout 1998, DOE prepared to begin a LEP for the W87. A HAR at the Pantex Plant for a LEP was completed; safety controls were identified in the HAR and in an Activity-Based Controls Document. As DOE was preparing to approve the activities base for the W87 LEP in early 1999, the Board's staff

identified a number of deficiencies. These included (1) a lack of adequate direction for readiness reviews; (2) inconsistent application of DOE Orders 425.1A, *Startup and Restart of Nuclear Facilities*, and 452.2A, *Safety of Nuclear Explosives Operations*, with regard to readiness reviews; and (3) ineffective validation of readiness, which adversely impacted the ability of MHC and DOE to confirm readiness for weapon operations before their startup/restart. In response to the staff's observations, DOE's Albuquerque Operations Office (DOE-AL) initiated an assessment of its readiness review process. DOE-AL improved its local directives and established a clear expectation that all future readiness reviews would conform to and meet the objectives of DOE Order 425.1A. Unfortunately, subsequent readiness reviews (e.g., the Readiness Assessment for the DOE-AL W62 Disassembly and Inspection [D&I] Program) have not met that expectation. Nevertheless, nuclear explosive operations under the W87 LEP began in early summer 1999 with a well-defined and effective safety basis.

W62 Disassembly and Inspection Program. The W62 is an enduring stockpile warhead used in the Minuteman III missile system. The NESS authorization for D&I of the W62 expired in 1997. DOE decided to revalidate the expired NESS in June 1998 instead of pursuing a tailored SS-21 set of actions to develop an improved set of controls that would then be the subject of a new full-scope NESS review. Such a revalidation process is allowed under DOE Orders related to nuclear explosive safety, but in some cases it is not advisable from a safety perspective. The Board noted that at this stage, the W62 was one of those cases; indeed, this observation was a principal reason for the Board's issuance of Recommendation 98-2. In response to this recommendation, DOE agreed that an additional hazard analysis and other actions would be needed to support safe D&I operations for the W62. These actions included reviews of the W62 authorization basis, a walkdown of the W62 operations, and development of a HAR and an Activity-Based Controls Document.

In a letter to DOE dated July 30, 1999, the Board emphasized the importance of completing safety improvement efforts for nuclear explosive operations in a timely and effective manner to support safe and reliable operations associated with the nation's enduring nuclear weapons stockpile. In addition, the Board observed that DOE needed to ensure the quality of each individual initiative to analyze operations and develop controls, as well as to carefully coordinate the interdependencies among separate safety improvement initiatives. The Board expressed its concern that the management attention and resources needed to resolve these issues had not been focused as necessary to meet safety and programmatic objectives.

A report prepared by the Board's staff, dated May 11, 1999, addressed DOE's efforts to upgrade the W62 safety basis and controls. The staff identified a number of areas requiring improvement in the development of W62-specific activities. Among these were the flowdown of controls to implementing (floor-level) documents, the effectiveness of the controls for fire suppression, and the apparent absence of failure modes and effects analyses for enhancements to tooling design. The staff also identified potential problems with the integration of various safety upgrade projects at Pantex.

A subsequent report by the Board's staff highlighted deficiencies in the information being provided to the Pantex contractor by the nuclear design laboratories concerning warhead response to specific environments, as well as in the use of this information for determining the

hazards and resulting controls associated with nuclear explosive activities. Although the Pantex contractor is responsible for conducting these safety analyses, only the nuclear design laboratories can provide such information. This input must be of the highest fidelity possible, with a defensible technical basis and a report of appropriate uncertainties, to be useful for safety basis development.

Also in December 1999, the Board's staff reviewed activities associated with the DOE-AL Readiness Assessment and the NESS for the W62 D&I. The staff found that the DOE-AL Readiness Assessment team did not conduct a sufficient review to justify its conclusions; the team was neither fully qualified nor adequately prepared, and did not devote sufficient attention to activities in the bay and cell. However, the intent of a Readiness Assessment (to validate that controls have been implemented and that the process is ready to start safely) was met because the NESS Group was able to compensate for the shortcomings of the Readiness Assessment team. Pantex is expected to complete the corrective actions resulting from these reviews and begin D&I operations in early 2000.

As a result of the Board's interactions with DOE, the safety basis for the W62 D&I process is better defined and controlled, and more effectively implemented. However, the Board believes that DOE and its contractor took an excessively long time to establish and execute an adequate safety basis for W62 D&I nuclear explosive operations. The objective of the Board's Recommendation 98-2 is ultimately to expedite these types of safety improvements.

Additional Safety Issues and Advances in Safety Management at Pantex

Throughout 1999, the Board and its staff identified or continued to pursue a number of additional matters that pertain more generally to the safety of all weapon system operations at the Pantex Plant. The following discussion highlights actions taken by the Board to address these matters.

Upgrades of Site-wide Basis for Interim Operation. In 1999, DOE and MHC continued to pursue initiatives to upgrade the Basis for Interim Operation (BIO) for the Pantex Plant; these initiatives began in 1997, primarily as a result of the Board's urging during the previous several years. The BIO contains analyses of common operations at the Pantex Plant, identifies hazards from a facility perspective or hazards that are common to more than a single weapon system, and demonstrates that the work can be done safely. The safety basis will retain an interim status until systematic safety analyses have been completed for all activities, and a site-wide ISM System has been fully developed. With technical input from the Board and its staff, DOE changed its goal to upgrading the site-wide BIO. The approach will now be to upgrade the BIO and implement it in a modular fashion by subject areas (e.g., lightning protection, on-site transportation, fire protection), rather than deferring implementation of new controls and safety improvements until all analytical work has been completed and approved. The new approach is intended to ensure that additional safety improvements will be made as expeditiously as possible. However, progress in this area has been disappointingly slow, and the Board has expressed its concern in this regard to DOE on a number of occasions. An additional complication has developed because DOE and its contractor have not done a good job of managing the interfaces between the BIO modules and other authorization basis initiatives.

Unless DOE senior management exhibits a significant increase in commitment to this effort in the coming year, the Board anticipates that this trend will continue well into 2000.

The following are additional examples of the Board's activities related to the site-wide BIO upgrades:

- ! **Lightning Protection**—In 1997, the Board requested that DOE prepare a technical report addressing the hazards posed by lightning to nuclear explosive operations at the Pantex Plant and the controls necessary to prevent and mitigate those hazards. In response, DOE established a project team to address the lightning protection issue. Since then, DOE and MHC have identified and installed additional protective measures. For most facilities, engineered controls (such as electrical bonding of metallic penetrations) are being implemented effectively. However, two problem areas continue to require attention: the development of concise and effective surveillance and administrative control procedures, and the installation of equipment to facilitate long-term maintenance of these controls. A letter to DOE dated September 21, 1999, forwarding a report by the Board's staff entitled *Lightning Protection for Nuclear Explosive Operation at Pantex*, acknowledged the substantive response by DOE and the Pantex contractor to the Board's observations and suggestions for upgrading of lightning protection measures at Pantex. With further progress on the completion of additional upgrade efforts, the Board anticipates closure of this issue in 2000.

- ! **On-site Movement of Nuclear Explosives**—The Board and its staff continue to emphasize the safe movement of weapons at the Pantex Plant. DOE's progress in this area during 1999 was limited. A draft BIO module for weapon transportation has been in development since 1997, yet was only recently (September 1999) submitted to DOE for approval. In a December 1999 letter to DOE regarding a subsequent review by the Board's staff, the Board concluded that integration of the appropriate safety analyses will require considerable work because of the large number of safety basis products involved, including the facility BIO and Technical Safety Requirements (TSRs), multiple BIO modules, weapon-specific HARs, and Activity-Based Controls Documents. Unfortunately, no evidence was provided to the Board's staff during its review that such an improvement had been initiated. The staff also found an almost exclusive reliance on administrative controls to provide protection. Implementation of the identified controls in 2000 may be difficult from operational, programmatic, and budgeting standpoints. These matters will be taken up with Pantex management in early 2000.

Pit Storage at Pantex

In 1992, DOE decided to cease the fabrication of pits for nuclear weapons at the Rocky Flats Environmental Technology Site and to begin the dismantlement of nuclear weapons. The pits from dismantled weapons have been stored in special containers, the AL-R8. It has been recognized for some time that the environment provided by the AL-R8 container used for both storage and shipping of pits is unacceptable for extended pit storage from the perspectives of

both safety and reliability, yet attempts to remedy the situation have to date been unsuccessful. Poor programmatic direction and management have led to large expenditures with little corresponding improvement in the storage conditions of the pits.

DOE policy decisions have established three classes of pits—those that are stockpile-capable, those for possible reuse, and those bound for disposition (known as “excess” pits). The first two classes make up the set of national security asset pits and are to be stored indefinitely, while pits in the third class are to be stored until they can be dispositioned. There is no comprehensive plan for pit management that outlines the way these general intentions are to be executed safely; however, a program commenced in July 1999 for upgrading the pit storage containers from the AL-R8 to the AL-R8 Sealed Insert (SI) in the interim. This interim upgrade was proceeding at a very slow pace, with 2006 being the most favorable estimated date for completion of repackaging. Accordingly, the Board issued Recommendation 99-1, *Safe Storage of Fissionable Materials called "Pits,"* on August 11, 1999. The Board recommended that DOE accelerate repackaging of pits into acceptable storage configurations.

At year’s end, DOE had drafted an Implementation Plan for Recommendation 99-1 that appears to address the Board’s technical concerns regarding pit repackaging on a timetable that may be the best attainable under the circumstances. However, an adequate Integrated Pit Management Plan (IPMP) addressing the broader pit management issues has yet to be provided. The Board expects development of the next revision of the IPMP to accelerate upon finalization of the Implementation Plan for Recommendation 99-1. The Board’s staff is closely monitoring DOE’s IPMP development activity, and expects to see an adequate plan developed and the repackaging program initiated in 2000.

3.1.2 Y-12 Plant

The Y-12 Plant, near Oak Ridge, Tennessee, is the site where nuclear explosive secondary components and weapon cases are fabricated. The Y-12 mission also includes fabrication, surveillance, inspection, and testing of some weapon components.

Enriched Uranium Operations Restart

Enriched Uranium Operations (EUO) at the Y-12 Plant involve a system of metallurgical operations (casting, rolling, forming, and machining), waste processing operations (thermal, solution, and wet chemistry processes), and metal production. These operations, among other nuclear activities at the Y-12 Plant, were suspended by the contractor in 1994 following the identification of numerous criticality safety problems. Resumption of operations conducted in Building 9212 is necessary to support high-priority national security missions.

In 1998, Phase A operations (metallurgical operations and waste processing) were restarted successfully. In addition, DOE’s Oak Ridge Operations Office (DOE-OR) and Lockheed Martin Energy Systems (LMES) committed to conducting an Operational Readiness Review (ORR) for Phase B metal production operations and associated activities. LMES decided to split the Phase B processes into Blocks 1 and 2, with the understanding that ORRs would be conducted for both blocks. An ORR for Block 1 processes, which encompass the

hydrogen fluoride (HF) system and a reduction furnace, was scheduled to occur in September 1999. However, as a result of delays in the construction of the HF system, DOE-OR and LMES decided in July 1999 to restart the reduction furnace separately from the HF processes. DOE-OR and LMES were planning to conduct a contractor Readiness Assessment concurrently with a “validation” by DOE-OR to confirm readiness for restart of the reduction furnace process. The justification for this less rigorous review included the perceived low risk of the operations, the small number of controls, and the observation that the operations were similar to those performed prior to shutdown. Additionally, DOE-OR management indicated that LMES would be the restart authority, with DOE-OR as an approval authority.

The Board’s staff reviewed the status (including the safety basis) of the planned restart of the reduction furnace in July 1999, along with the less rigorous approach to ensuring readiness to operate safely. As a result of subsequent interactions with the Board, DOE-OR agreed to perform an independent DOE Readiness Assessment for the reduction furnace, as required by DOE Order 425.1A, *Startup and Restart of Nuclear Facilities*. The DOE Readiness Assessment eventually revealed numerous safety issues. DOE ultimately concluded that the process was not ready to resume operations safely. DOE and LMES are now reviewing their approach to the safe startup of wet chemistry operations.

Additionally, on December 13, 1999, the DOE Facility Representative in Building 9212 identified a fissile material container located in a storage array that was not permitted by the governing nuclear criticality controls. This nuclear criticality safety concern was immediately confirmed by LMES, but a further search revealed no other suspect containers. On December 14, 1999, however, the DOE Facility Representative found an additional container not in accordance with storage array limits. Since the search by LMES staff had failed to reveal this container, the DOE Facility Representative directed that all fissile material handling activities in Building 9212 be stopped. On December 16, 1999, DOE issued a memorandum formally confirming the stop work order, requesting a corrective action plan within 5 days, and confirming that resumption of fissile material activities in Building 9212 would require DOE approval. Resumption of those activities will now have to be factored into EUO restart plans.

Design and Construction Projects

The Board believes that replacing aged defense nuclear facilities and maintaining a technically competent staff to build and manage those facilities are two of the most important safety challenges currently facing DOE. Activities by DOE and LMES to resume EUO and construct the Highly Enriched Uranium (HEU) Materials Facility are key projects requiring Board attention to ensure that these safety challenges are being met.

Following reviews of recent facility upgrades at the Y-12 Plant and a staff assessment of the conceptual design report for the HEU Materials Facility, the Board transmitted a letter to DOE dated May 2, 1999. In this letter, the Board noted that (1) an increased effort was required to integrate safety into the planning process and ensure the overall success of these projects, and (2) a disciplined process for controlling the design of facilities—based on the principles of systems engineering and ISM, as well as the guidance contained in DOE Order 430.1A, *Life Cycle Asset Management*—would be appropriate.

Continuing problems with the HF supply system project (which, as noted above, supports resumption of EUO activities) and safety management issues prompted the Board to delve into other aspects of EUO activities. ISM for Y-12 design and construction programs was lacking. As a result, the Board sent a letter to DOE dated November 9, 1999, observing that the contractor's safety management leadership was weak in this life-cycle phase. The Board noted that the responsible managers lacked detailed involvement in and understanding of all aspects of the project, from design and procurement to testing and evaluation. The Board also noted that DOE had not exercised its oversight responsibilities to identify safety problems, determine their cause, and undertake necessary steps to prevent their recurrence.

As a result of these findings, the Board requested that DOE prepare a report addressing how it intends to (1) identify the root causes of problems associated with the execution of ISM principles during design and construction, and (2) resolve those and other safety issues. The Board also requested that once the root causes have been identified, DOE provide an additional report outlining the corrective actions to be taken to remedy the causes and the associated problems, as well as specifying the necessary changes to ISM practices at the Y-12 Plant.

Safety Basis

In June 1999, the Board's staff conducted a review of the safety bases for Y-12 nuclear facilities, identifying inconsistencies and deficiencies in the authorization bases. Unreasonable delays in approval of the authorization basis documents led to schedule slips in the development of Safety Analysis Reports (SARs) and an overreliance on the use of cursory BIOs. The staff also observed that LMES and DOE-OR had decoupled their approval of the SARs (i.e., analysis), which do not adequately address the safety of the public, workers, and the environment, from their approval of the TSRs (i.e., controls), thus introducing inconsistencies. DOE-OR and LMES acknowledged these problems and indicated they would attempt to improve the situation through reorganizations and the conduct of workshops. In an October 6, 1999, letter to DOE, the Board transmitted the results of the staff's review of the Y-12 safety basis. In response to that letter, DOE-OR has directed LMES to accelerate its schedule for updating the authorization bases for its nuclear facilities, and to ensure that all safety basis analyses and documentation for nuclear facilities meet the goal of DOE Order 5480.22, *Technical Safety Requirements*, and DOE Order 5480.23, *Nuclear Safety Analysis Reports*, as soon as practical. Both DOE-OR and LMES plan to acquire additional technical talent through the use of excepted service and subcontracting.

Secondary Dismantlement

In August 1999, the Board's staff conducted a review of (1) safety basis documentation and preparations for surveilling canned subassemblies, and (2) the first new dismantlement campaign in more than 5 years for dismantlement of weapon secondaries at the Y-12 Plant. In a letter to DOE dated November 11, 1999, the Board transmitted a report documenting the results of this review. The staff observed that delays in establishing an updated authorization basis were continuing, and noted inadequacies in the performance of job hazard analyses in Unreviewed Safety Question Determinations, and in implementation of safety-related controls.

Year 2000 Issues

In a letter to DOE dated November 24, 1998, the Board transmitted an issue report prepared by its staff, identifying Year 2000 (Y2K) issues at the Y-12 Plant. A follow-on staff review of electrical and instrumentation and control systems at the Y-12 Plant was conducted in March 1999. At that time the staff observed that DOE had acknowledged the issues raised in the report, and encouraged DOE to continue its efforts in addressing those issues.

Chemical Hazards

In reviews conducted in 1998 and 1999 regarding the management of chemical hazards at the Y-12 Plant, the Board's staff identified problems with activity-level work planning, related specifically to the identification and analysis of hazards and the subsequent development and implementation of controls. These problems contributed to circumstances that led to a number of fires and explosions involving lithium operations (the latest fire occurring on December 14, 1999), as well as a chemical explosion involving depleted uranium operations (on December 8, 1999).

In May 1999, the Board's staff conducted a follow-up review of the management of chemical hazards at the Y-12 Plant. In a letter to DOE dated July 8, 1999, the Board transmitted the findings of this review, highlighting the contractor's tardy response to Secretarial directives; a lack of up-to-date, accurate information concerning the inventory of potentially hazardous chemicals; and failure to follow up on open occurrence reports and Unreviewed Safety Question Determinations. In response, DOE has stepped up efforts to complete a chemical management program at the Y-12 Plant, including a renewed commitment to characterizing chemical inventories for emergency planning purposes and to disposing of excess chemicals. DOE-OR issued a chemical safety action plan on September 23, 1999, but did not allocate resources for its implementation until November 15, 1999. The schedule for this plan, therefore, is not being met. The Board will continue to stress this issue with senior DOE management.

Emergency Management

During a visit to the Y-12 Plant in May 1999, the Board's staff reviewed the implementation by DOE-OR and LMES of DOE Order 151.1, *Emergency Management*. The staff found that the DOE emergency management program was ineffectively led and supported by senior DOE management. In response to a letter from the Board dated July 8, 1999, DOE-OR assembled a working group that prepared and then began executing a corrective action plan. Though implementation of this plan extends to June 2000, DOE-OR is devoting high levels of management attention and adherence to the plan's schedule and deliverables. The Board will monitor this progress closely until the action plan has been completed.

Review of Worker Protection

In December 1998, the Board's staff conducted a review of worker protection for maintenance and operations in Building 9212 E-Wing and for construction of the HF system. It was not apparent to the staff that work planning and control processes in effect at the Y-12 Plant

could be adequately and consistently relied upon to ensure worker safety. In a letter to DOE dated January 28, 1999, transmitting an issue report on the subject prepared by the staff, the Board noted that the rigor that characterized the performance of hazard analyses for lithium hydride operations was not being applied universally across the site (i.e., in design and construction activities and in maintenance and operations in E-Wing). In addition, the Board's staff identified issues regarding the use of respirators in high-airborne-activity areas in E-Wing. In response, DOE is developing additional engineered controls to mitigate the elevated levels of airborne uranium.

Overall, the Board's oversight of the Y-12 activities relative to safety has revealed the need for Y-12 to strengthen its work planning/safety planning program and its conduct of operations. The Board has engaged DOE's senior officials on this matter which is now receiving DOE attention. The Board will continue to monitor the situation.

3.1.3 Savannah River Site

The tritium facilities at SRS, located near Aiken, South Carolina, have a vital role in stockpile management—ensuring the nation's capability to replenish certain weapon components with tritium gas and to process and store the gas. Tritium, a radioactive isotope of hydrogen, has a relatively short half-life (12.3 years) and must be replaced periodically. Tritium was last produced in the K-Reactor at SRS, which was shut down in 1988. Currently, DOE does not have the capability to produce tritium. The H-Area tritium facilities at SRS consist of Buildings 233-H (formerly the Replacement Tritium Facility), 232-H (tritium extraction facility), 238-H (tritium reclamation facility), and 234-H (tritium receiving, packaging, and storage facility).

Production of Tritium

On May 6, 1999, the Secretary of Energy issued a consolidated Record of Decision for the tritium supply program. The Commercial Light Water Reactor–Tritium Extraction Facility alternative was chosen as the primary supply program to support national stockpile management activities. The Accelerator for Production of Tritium (APT) alternative was designated as the backup; this project is scheduled to continue with developmental work and completion of the preliminary design. During the past year, the Board by request briefed the U.S. Department of Defense's (DoD) Defense Science Board and representatives of the U.S. General Accounting Office on the technical advantages and disadvantages of these tritium production alternatives. In general, the APT project requires more engineering development and will take longer to bring into production; with proper oversight, however, either alternative can be operated safely. During 1999, the Board's efforts focused upon the review of the safety aspects of designs being developed for these facilities.

Safety Analysis Report for Consolidated Tritium Facility

The Board's staff has been actively involved in reviewing the SAR for the Consolidated Tritium Facility, which combines the safety basis documentation for all tritium facilities in the H-Area at SRS. Since 1993, WSRC has been engaged in developing authorization basis documentation for SRS facilities, an effort that includes upgrading SARs to meet the

requirements and implementation guidance of DOE Order 5480.23, *Nuclear Safety Analysis Reports*. In producing the SAR for the Consolidated Tritium Facility, the latest DOE guidance and industry standards were used to perform hazard analyses and identify the controls needed to protect the public and workers. The Board's reviews and subsequent interactions with the DOE-SR and WSRC resulted in changes to the assumed worst-case fire scenarios.

Conservative industry standards and practices were used in the design and safety analyses for the Consolidated Tritium Facility. The result is a design more likely to provide the preventive and mitigating functions required of vital safety systems. An important example of this is the application of revised National Fire Protection Association guidance in estimating the maximum room temperature in an unmitigated fire. For some fire scenarios, the new analysis estimates the average room temperature during a fire to be higher than was previously assumed. The new analysis also emphasizes the importance from a risk reduction standpoint of preventing such large fires and avoiding the associated higher temperatures, which would exceed the environmental qualification of some existing safety-class systems and components. The control of incipient fires through use of a more reliable fire suppression system would make large fires less likely to occur. To reduce the predicted likelihood of such fires to the "extremely unlikely" level, WSRC reclassified the fire suppression (and some detection) systems as safety class. TSRs will be applied to fire protection systems falling in this category. In addition, administrative controls on combustibles will be used to provide greater assurance that combustible loading limits will not be violated.

As a part of its conservative design development, WSRC used defense in depth in establishing the safety features for the consolidated tritium facilities. Use of this approach will result in a design in which multiple barriers would have to be breached in series during accident conditions before radioactive materials would be released outside the work stations. The Board encouraged and commended the use of defense in depth by WSRC and urge DOE to apply the principle more widely. The Board will continue to monitor the design development as it progresses.

Non-Nuclear Reconfiguration

The Board and its staff have devoted substantial effort to overseeing the safety aspects of the development and startup of new tritium-related activities associated with the Non-Nuclear Reconfiguration program. In December 1999, the Board's staff reviewed the design and safety analyses associated with the Tritium Facilities Modernization and Consolidation (TCON) project. The TCON project will relocate existing tritium process capabilities and equipment from older to more modern tritium facilities through several construction projects, including a major modification to Building 233-H and the construction of a new environmental chambers/contaminated metallography laboratory, Building 234-7H. The intent of the TCON project is to improve the safety of operations, reduce environmental releases, improve productivity, and reduce operating costs. Revisions to the authorization basis for the Building 233-H modification and the Consolidated Tritium Facility SAR for Building 234-7H are being developed as part of the modernization effort.

By year's end, the Board's staff had reviewed the draft SAR Addendum for Building 234-7H. The staff found the overall quality of the hazard analysis and functional classification of structures, systems, and components to be adequate. The Board will continue to encourage WSRC to use engineered design features instead of administrative controls (e.g., fire suppression versus emergency planning) for worker protection. The Board's staff will continue to follow the progress of the TCON project and tritium operations to ensure that the quality of the authorization basis is maintained and that identified safety controls are adequately implemented.

3.2 STOCKPILE STEWARDSHIP OF NUCLEAR WEAPONS

Stockpile stewardship is the term used by DOE to refer to activities carried out in the absence of nuclear 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-nuclear 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.

3.2.1 Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory, located 45 miles southeast of San Francisco, California, is a DOE 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 Building 332 (B332) Plutonium Facility and the Tritium Facility.

Integrated Safety Management at the Superblock

LLNL halted operations at the B332 Plutonium Facility in July 1997 as a result of issues related to safety management, criticality safety, and conduct of operations. In 1998, LLNL developed and implemented a plan for resumption of Plutonium Facility operations. This plan incorporated rigorous compensatory measures to permit the resumption of operations in stages, provided for iterative improvements in work practices in subsequent work, and allowed for the gradual development of standing work practices. In 1999, the standing practices for the Plutonium Facility were documented in a work control manual and in facility and operations safety procedures. The practices were generally applied to the other Superblock facilities.

Throughout 1999, the Board and its staff continued to review actions aimed at upgrading the safety management program at the B332 Plutonium Facility and the remainder of the Superblock. In a letter to DOE dated May 6, 1999, the Board noted that significant improvements had been implemented at the B332 Plutonium Facility, and that continuing progress on safety enhancements could best be achieved through full development and implementation of an ISM System. The staff continued to focus on helping to develop and improve programs and procedures for LLNL's nuclear facilities and related programmatic

activities with regard to the identification of hazards and implementation of controls for operations and storage involving special nuclear and radiological materials. The Board and its staff also assisted DOE's Livermore Site Office in developing a capability to monitor and ensure safe operations at LLNL's defense nuclear facilities.

In developing a process for the resumption of operations at the Plutonium Facility, LLNL developed and, to a large degree, implemented an ISM System. The Superblock developed its own ISM System Description because it was significantly ahead of the rest of LLNL in implementing more rigorous safety practices for its operations. The Superblock completed its ISM System verification in September 1999. Although several areas for improvement were noted (particularly with regard to developing and maintaining safety bases, feedback, and improvement), the Superblock ISM System Description was considered acceptable, and an ISM System is being implemented at the Plutonium Facility. An ISM System is also being implemented in the Tritium Facility and the Hardened Engineering Test Facility. Activities are also underway at the site-level to address systemic issues such as those noted above.

Electrical and Instrumentation and Control Systems

As a result of a review conducted in October 1999, the Board's staff found that LLNL's emergency power system did not meet current safety-class standards and that the preventive maintenance and calibration program for the emergency power system was inadequate. In a letter dated December 21, 1999, the Board so advised DOE. The Board's letter also noted other potential areas for improvement, such as (1) addressing the inadequacy of mechanical supports for certain components of the safety-class electrical power system in the event of a significant earthquake, (2) developing appropriate standards and guides for safety-related instrumentation and control systems, and (3) providing for an adequate lightning protection system for Building 332. The Board's staff will continue to follow these issues until they are resolved.

3.2.2 Los Alamos National Laboratory

Los Alamos National Laboratory, located in northern New Mexico, is the DOE weapons laboratory with the largest number of defense nuclear facilities and weapon-related activities. It is the main site for ongoing research and development regarding means of certifying the safety and reliability of nuclear weapons in the absence of nuclear testing. LANL will also be the location of DOE's limited-scale capability for manufacturing replacement pits for nuclear weapons.

Integrated Safety Management for Criticality Experimentation

Nuclear criticality research and development activities are performed at TA-18 Pajarito Laboratory. Operations at TA-18 were halted by LANL management on August 12, 1998, as a result of a series of occurrences that indicated deficiencies in planning and scheduling of work, inadequate procedures, and problems with formality of operations. The Board's staff reviewed the ensuing resumption plans in late 1998 and closely followed the resumption process throughout 1999. As part of the resumption process, a comprehensive safety management assessment was conducted. This assessment identified a number of issues with regard to

organizational structure and management systems. Satisfactory resolution of key issues and action items has permitted the incremental resumption of activities.

Complications encountered in updating the SAR, along with other issues, led the Board's staff to propose an alternative approach that would permit the signing of an Authorization Agreement after completion of a BIO by addressing the core safety requirements of DOE Order 5480.23, *Nuclear Safety Analysis Reports*. In a September 1999 review, the Board's staff noted that the TA-18 facility was operating under restricted conditions, without an Authorization Agreement, and suggested that DOE and LANL complete an interim Authorization Agreement to confirm the acceptability of and limits on current operations. LANL subsequently agreed to issue an interim Authorization Agreement and has prepared one that has now been approved by DOE. It includes a commitment to complete the BIO by May 31, 2000, and the final Authorization Agreement 1 month later.

Potential Relocation of Technical Area-18 Activities

As discussed earlier, DOE had directed LANL to investigate alternatives for moving the activities at TA-18 to another location in order to upgrade security measures. During a visit to NTS on September 28–29, 1999, the Board's staff was advised that the feasibility of moving the TA-18 activities, the Sandia Pulse Reactor III, and special nuclear materials to the DAF was under review. However, only the cost of the physical relocation of these activities to DAF was being considered; the associated safety requirements and the potential cost of upgrading DAF as necessary to collocate these activities with existing and planned DAF missions were not being addressed.

Early identification of mission and objectives is key to successful decision making for large projects such as the potential relocation of TA-18 activities. DOE has now established an options study group to address the potential relocation of TA-18 activities originally scheduled to be completed during a period of about 6 months, but now accelerated to be done in 4 months. There are several national security programs that would be affected by the relocation, and for which mission statements and objectives, including continuity of operations, need to be developed. These programs include critical experiment research and development in support of the nuclear weapons program; emergency response for incidents involving special nuclear materials; and nonproliferation-related programs, such as counterterrorist training. The impact on current and planned operations also needs to be addressed for each of the alternatives. The Board is concerned that the planned move may lead to the potential loss of technical expertise now resident at LANL arising from any geographical relocation of TA-18 activities. Because of the negative effects such a loss would have on criticality safety training, the Board intends to maintain its position that no steps in remediation of this situation should weaken the program of training criticality engineers—a crucial program needed to prevent criticality accidents in DOE's facilities.

The Board continues to devote attention to certain developments affecting the future viability of DOE's programs for prevention of criticality accidents. The Board will maintain the position that no steps in remediation of this situation should weaken the program of training the

criticality engineers needed to prevent criticality accidents in DOE's facilities. The Board will continue its review of the safety implications of these alternative studies.

Hydrodynamic and Dynamic Experiments

LANL plans to conduct a series of hydrodynamic and dynamic experiments as part of the stockpile stewardship program. Several issues remain to be resolved before operational readiness for these experiments can be declared, including updates to the safety analysis and technical safety specifications, and DOE must review and approve the revised authorization basis.

Needed upgrades to lightning protection have not yet been initiated, but LANL has assured the Board's staff that it remains committed to making those upgrades. The final SAR and TSRs need to be updated to address new information on hazards (including the lightning hazard and new mitigation controls). LANL expects these updates will soon be completed. Several safety issues remain unresolved and are being followed by the Board's staff.

The Board's staff has been reviewing the safety basis for these experiments for several years. Inadequate resource allocations by LANL have caused delays in the program, but new management has pledged strong backing for startup in 2000. DOE directed LANL to appoint experts to a blue ribbon panel that would review the safety of the experiments. The Board has proposed, and DOE has accepted, a broader charter for this panel. Members of the panel have been named, and they held their first meeting in September 1999.

A credible resource-loaded schedule for the program is not yet available. Current plans call for the contractor and DOE to conduct ORRs during 2000, and authorization to proceed with the experiments is anticipated as early as May 2000. However, no plan of action for either readiness review is yet available.

Worker Protection

As part of ongoing improvement of the implementation of ISM at the activity level, the Board's staff reviewed the plans for implementation of activity-level worker protection practices in research and development at DOE facilities. On July 26, 1999, the Board sent a letter to DOE commending LANL for its substantial implementation of ISM concepts. The Board also noted that a number of practices could be improved further. Examples include providing better guidance to workers for writing hazard control plans, estimating risks of activities, using integrated teams to plan work, performing hazard analyses using various methodologies, and conducting ISM System training. Since the staff's review, LANL has issued revised manuals and codes of practice that appear to incorporate several of these improvements.

Facility Upgrades

The Board continued to review facility upgrades, focusing on safety management processes and practices for a number of important nuclear projects. For several years the Board has emphasized the need for more effective management of construction projects at LANL to

ensure that health and safety risks are identified early, and effective controls are developed during the design stage. In a letter to DOE in December 1997, the Board also stressed the need for LANL to develop appropriate project management controls consistent with DOE Order 430.1A. In its June 2, 1998 response to the Board's letter, DOE concluded that such changes were necessary for all stockpile management construction projects at LANL.

DOE and LANL have taken significant initial steps to improve the safety management of stockpile management projects, including an overall long-term strategy for resolving related problems. During 1999, DOE and LANL completed agreements on incorporating DOE Order 430.1A in the DOE/University of California contract for the management of LANL. While this was a significant initial step, DOE and LANL have not reached agreement on their respective roles, responsibilities, and authorities, nor have they fully elaborated the contents typically expected in key documents such as program requirement documents, design criteria, project execution plans, baseline documents, and design reports.

In a review conducted in June 1999, the Board's staff identified deficiencies related to site-wide requirements for electrical, instrumentation and control, and fire protection systems. In a letter to DOE dated September 22, 1999, the Board observed that although the current LANL standards provide extensive direction on the design of industrial electrical systems, LANL has not required any standards related to the design of safety-class or safety-significant systems. Thus, there is little contractual assurance that safety-class and safety-significant systems within new or upgraded facilities will meet DOE's requirements. However, LANL stated its intention to add to its contract with DOE both the Institute of Electrical and Electronics Engineers Class 1E standards for electrical systems and the Instrument Society of America Standard S84.01 for safety-related instrumentation and control systems.

In addition, the Board's staff concluded that the contract for operating LANL does not include many of the specific program requirements for fire protection that are in DOE Order 420.1, *Facility Safety*. Moreover, the LANL implementation guidance for fire protection is not fully reflective of either DOE Order 420.1 or other DOE guidance on fire protection.

The Board further indicated that the Work Smart Standards need to be upgraded to include standards for safety-related systems, to ensure that LANL adheres to established and proven industry design practices for safety systems. These upgrades are especially important given the near-term need to design and construct new facilities, such as a replacement for the Chemistry and Metallurgy Research Facility. The Board also noted that it expects the Work Smart Standards for safety-related systems to comply with the safety system requirements in DOE Order 420.1.

3.2.3 Nevada Test Site

Underground testing of nuclear weapons is no longer being conducted at NTS. However, NTS is required to maintain readiness for resumption of underground testing within a certain time frame, if required by the President to do so.

Subcritical Experiments

The subcritical experiments program at NTS is a vital materials research component of DOE's stockpile stewardship and management program. Subcritical experiments involve devices containing both high explosives and special nuclear material. The experimental configurations are designed, however, to preclude the possibility of nuclear criticality.

During 1999, the Board and its staff reviewed proposed operations for an upcoming series of experiments. These experiments, subsequently conducted by LLNL, used vessels for containment, thereby allowing reuse of individual underground chambers (which are expensive to excavate). The staff found that the proposed operations had been adequately reviewed by DOE under the existing safety management program for subcritical experiments.

Disposition of Damaged Nuclear Devices

The potential exists that DOE might sometime in the future be faced with the need to deal with a damaged nuclear device (DND). The Board has been exploring this matter with DOE officials. DOE's capability to safely perform the work necessary to dispose of DNDs is rapidly disappearing. In the past, maintenance of the facilities and personnel necessary to support this mission depended on nuclear test resources and expertise. However, the personnel and the facility infrastructure required to support testing operations are diminishing. Planning DND operations so they can be executed safely presents a unique challenge.

In September 1999, DOE outlined a path forward to address these matters. A disposition focus group involving key DOE and laboratory personnel has been tasked to define the basic elements and associated resources needed to reestablish and maintain a long-term capability to conduct DND work safely. In turn, this group has chartered an exercise working group to plan and conduct DND disposition exercises aimed at evaluating the adequacy of command arrangements, as well as the state of readiness of the personnel and facilities necessary for DOE to conduct this mission safely. Although the disposition focus group has conducted initial meetings to define its charter and to begin development of the list of issues that must be addressed, much work remains. Progress continues to be slow, and increased attention by senior management is vital to this mission. The Board will continue to pursue this activity.

3.2.4 Sandia National Laboratories

Sandia National Laboratories manages research and development installations at several sites, particularly Albuquerque, New Mexico, and Livermore, California. SNL has a major responsibility to conduct engineering research and development on nuclear weapons systems and components. All of SNL's major defense nuclear facilities are located at the New Mexico site; they include the Annular Core Research Reactor, the Hot Cell Facility, the Gamma Irradiation Facility, and the Sandia Pulsed Reactor Facility, all located in Technical Area-V. The Manzano Waste Storage Facilities and the Neutron Generator Facility are located elsewhere at the New Mexico site.

During 1999, the Board's staff assessed the status of ISM System implementation at the Sandia Pulsed Reactor Facility and the Gamma Irradiation Facility. The commitment to an ISM System on the part of TA-V management was evident, but full flowdown to the activity and worker levels is still ongoing. The Board's staff is continuing to follow the progress of ISM System implementation at this site.

3.3 DEFENSE PROGRAMS-WIDE TOPICS

3.3.1 Recommendation 93-1/Nuclear Explosive Safety Study Corrective Action Plan

For several years, the Board has worked with DOE to improve the directives governing the safety of nuclear explosive operations. In implementing the Board's Recommendation 93-1, *Standards Utilization in Defense Nuclear Facilities*, and the NESS corrective action plan, DOE produced a revised and expanded set of safety-related Orders, standards, and guides that, taken together, significantly improved the definition of what DOE expects of its contractors to ensure the safety of operations. In carrying out the last open action of the response to this recommendation, DOE formally issued a standard that provides guidance on the preparation of HARs for nuclear explosive operations. In 1999, the Board closed Recommendation 93-1 and encouraged DOE to continue to seek ways of simplifying the process developed for implementing the new Orders. This matter of simplification was stressed again by the Board in its Recommendation 98-2.

3.3.2 Collection and Analysis of Safety-related Information

During 1999, the Board closed Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*, which urged DOE to capture the safety-related design and operational knowledge of experts within the complex. DOE's Office of Defense Programs had initiated several programs for preserving and archiving this knowledge at the nuclear weapons laboratories, NTS, the Pantex Plant, and the Y-12 Plant.

One of these programs involved the status of the development of system-specific weapon safety specifications. The Board's staff performed a comprehensive review of the weapon safety specifications for the W56, W76, and W83 nuclear weapon systems. This review revealed deficiencies that were determined to hinder the efficient development of HARs for nuclear weapon operations at the Pantex Plant. In addition, identification of lessons learned from the nuclear weapons complex and substantive archival data were found to be lacking in the weapons safety specifications reviewed. The Board communicated this finding to DOE, and actions were subsequently initiated to increase the efficacy with which the nuclear design laboratories supply weapon response information in support of HAR development. The Board's staff continues to follow this issue, with particular emphasis on making the maximum use of archival data and information on lessons learned.

3.3.3 Weapon Surveillance Program

The Board continues to monitor DOE's weapon surveillance program to determine whether adequate attention is being given to the safety of activities and to safety-related materials and components. Members of the Board's staff attended the 1999 Annual Enhanced Surveillance Program Review at the Allied Signal Kansas City Plant in March 1999. In May 1999, members of the staff reviewed aging of high explosives in weapon components. High explosives in the main charge and other components are carefully reviewed in the Enhanced Surveillance Program because these materials are very energetic and subject to change over time. In addition, the staff reviewed the aging characteristics of high explosives and how they may affect the safety of weapon handling. The staff is continuing to follow ongoing studies of high explosives in main charges, detonators, and other components for indications of significant changes.

In March 1998, the Board urged DOE to reexamine the significant finding investigation (SFI) system. DOE subsequently changed its policy with regard to SFIs to require the design laboratories to act on all significant finding notifications within 30 days of reporting. Also, LANL has opened an increased number of SFIs in recent years.

The Enhanced Surveillance Program is now in its fifth year, and several significant elements of the program are being reviewed and monitored by the Board's staff. In the study of pit materials, several mature projects to support determination of pit lifetimes are nearing conclusion, although lifetime projections have not been developed. High explosive studies done in support of stockpile life extension programs are approaching the point at which analysts can provide lifetime projections for the high explosives in several weapon systems. Also, several non-nuclear components are being examined—in a risk-based prioritized manner—for defects that could affect safety. The design laboratory is on track to support studies of non-nuclear components in the W76 and the W80 stockpile life extension programs.

3.3.4 Handling of Insensitive High Explosives

Following a comprehensive review by its staff, the Board issued DNFSB/TECH-24, *Safe Handling of Insensitive High Explosive Weapon Subassemblies at the Pantex Plant*. In this report, the Board observes that the technical basis for performing operations on composite insensitive high explosive (IHE) and conventional high explosive (CHE) subassemblies does not fully support the assumptions used in establishing safety controls. For such subassemblies, the inferred negligible likelihood of violent reaction in credible abnormal environments at Pantex cannot be statistically defended on the basis of the small number of tests performed. As noted in DNFSB/TECH-24, the size of the CHE booster or the level of stimulus that would cause the CHE to react with enough power to initiate the IHE main charge to a violent reaction is unknown. In the letter forwarding this report to DOE, dated December 6, 1999, the Board requested that DOE reexamine its technical safety basis for handling composite IHE/CHE weapon subassemblies. Additional modeling, experimentation, and analysis would clearly strengthen DOE's understanding of the safety margin in handling this class of subassemblies.

4. HAZARDOUS REMNANTS OF WEAPONS PRODUCTION

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As DOE attempts to close facilities and sites that are no longer needed for weapons production, it is faced with many unique challenges. Numerous one-time activities must be accomplished safely to ensure adequate protection of the public, workers, and the environment. The Board has consistently encouraged DOE and its contractors to undertake these activities in a methodical and controlled manner; that is, they must understand the hazards presented by the activity and materials involved, control those hazards, perform the work using appropriate safety controls, and learn how the activity could be performed better. These are fundamental tenets of ISM embodied in the Board's Recommendation 95-2, *Safety Management*.

In Recommendations 94-1, 95-1, 96-1, 97-1, and 99-1, the Board urged DOE to take action to correct the storage problems resulting from the shutdown of many defense nuclear facilities, recognizing that such unsafe conditions would become worse with time. Since then, DOE has taken action to mitigate some of the most immediate concerns, but much of the

material has yet to be stabilized and packaged for long-term storage or prepared for ultimate disposition. This need to stabilize and confine unsafe material is seen by the Board as having the utmost urgency.

During the processing of material for stabilization, packaging, and storage, it is important for safety that the fundamental tenets of ISM be satisfied. Such control remains essential as DOE facilities no longer needed for the weapons mission make the transition to deactivation and decommissioning. In many cases, greater hazards, particularly to workers, arise during deactivation and decommissioning of these facilities than those which existed when the facilities were in operation.

In the discussion that follows, the Board reemphasizes the importance of stabilizing and packaging legacy materials on an expedited basis and providing the necessary resources to accomplish this objective. This is not a matter of preference; rather, it is an issue of public health and safety that must be dealt with aggressively. The Board intends to assist DOE in this regard through its strong focus on the safety of defense nuclear facilities and activities and through its analysis of issues deserving high-priority attention.

4.1 STABILIZATION OF LEGACY MATERIALS

Significant stabilization of nuclear materials has been accomplished under the Board's Recommendation 94-1. The Board continues to monitor DOE's progress on the Implementation Plan for this recommendation and to request adjustments to the plan as required. Accomplishments include mitigation of urgent risks (e.g., the repackaging of plutonium in contact with plastic, the venting of thousands of drums containing plutonium residues to prevent the buildup of explosive gases, and the stabilization of a number of types of nuclear materials), and development of a plutonium storage standard (DOE-STD-3013), together with the processes and equipment necessary to meet this standard. The more important hazards have been mitigated, and large quantities of nuclear material have been stabilized, including more than 300,000 liters of plutonium-239 solutions, nearly 16,000 deteriorating Mark-31 spent fuel elements, and more than 13,000 liters of plutonium-242 solutions.

In December 1998, DOE drafted a revision to the Implementation Plan for Recommendation 94-1 to update the remaining activities and reflect changes in the approach from the original plan of 1995. However, the revision was incomplete in key areas. Several plutonium stabilization, packaging, and storage plans had been removed because of DOE's decision not to proceed as planned with construction of the Actinide Packaging and Storage Facility (APSF) at SRS. This decision disrupted the SRS plan for stabilization, packaging, and storage of plutonium, as well as stabilization plans at Hanford's Plutonium Finishing Plant and other sites in the complex.

The Board responded to the proposed Implementation Plan in a January 1999 letter to the Secretary of Energy, accepting the plan subject to three conditions. The first two conditions were partially satisfied by a March 26, 1999, letter from DOE providing contingency plans for stabilization of HEU solutions at SRS and a path forward for stabilization of classified metal

parts at RFETS. However, DOE has not adequately responded to the third condition that it evaluate the impact of not constructing the APSF as planned, and develop a path forward for achieving the desired end-states for the affected materials. To satisfy this third condition, DOE studied alternatives for stabilizing and packaging SRS plutonium and also evaluated the storage requirements for stabilized plutonium packages. These studies were completed earlier this year, but DOE has not yet decided on a path forward.

On September 9, 1999, the Board held a public meeting to gather information relative to the reasons for delays in finalizing the revised Implementation Plan and accomplishing specific stabilization activities, and to identify actions necessary to complete the remaining stabilization activities in a timely manner. DOE personnel provided the status of delayed activities that involve processing uranium and plutonium into stable storage forms, packaging plutonium for interim storage, stabilizing spent fuel, and maintaining the facilities needed to perform these activities during the next few years. The Board followed up on matters addressed during the public meeting by letters to DOE dated September 22 and November 15, 1999. The thrust of the Board's correspondence was to urge DOE to devote the high-priority attention and resources required to stabilize and store these unsafe materials, as had originally been committed to by the Secretary of Energy. The desirability of such stabilization is not the issue, but apparently the allocation of funds relative to other tasks is. This impasse led the Board to issue Recommendation 2000-1, *Prioritization for Stabilizing Nuclear Material* in January 2000. This recommendation addresses a priority-based approach for dealing with these legacy materials, based upon such considerations.⁴ The Board is prepared to work with DOE to restructure the program accordingly.

4.1.1 Plutonium

Stabilization of Plutonium Metals and Oxides

In Recommendation 94-1, the Board urged DOE to place plutonium metals and oxides in storage configurations that meet DOE's standard for long-term storage (DOE-STD-3013, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage*). The Board and its staff have continued to actively follow each site's preparations for stabilizing and packaging plutonium metals and oxides to this standard. During 1999, the Board successfully worked with DOE to ensure that the revision to DOE-STD-3013 currently being finalized would continue to provide effective criteria for safe, long-term storage of plutonium metals and oxides. In December 1999, the Board issued a letter to DOE concurring with the revised storage standard and requesting clarification of how a particularly important requirement controlling the scope of the standard would be implemented in practice.

⁴ Recommendation 2000-1 presents the Board's determination of the relative risk for most of the materials remaining to be stabilized. The recommendation also urges the Secretary of Energy to comply with the provision of the Atomic Energy Act to report situations in which implementation of the Board's recommendations is impracticable because of budget constraints. The Board will continue to follow DOE's implementation of Recommendation 94-1 and to urge DOE to address the remaining problems.

DOE continues to make some progress on stabilizing plutonium metals and oxides. At the Hanford Site, progress is being made in thermally stabilizing plutonium in accordance with DOE-STD-3013, albeit slowly and without packaging per the standard's requirements. SRS has packaged numerous plutonium metal items in welded cans that may serve as the inner containers in DOE-STD-3013 packages. However, no site except LLNL is currently packaging materials in full compliance with DOE-STD-3013, and the SRS inner-canning system has been shut down because of significant contamination of an FB-Line vault after a weld on one of the cans failed. The deferral of construction of APSF will further delay DOE's progress.

A prototype automated plutonium stabilization and packaging system is currently being installed at RFETS. RFETS has raised the issue that this system may not be able to meet the DOE-STD-3013 requirement to avoid contaminating the outside of the inner can. RFETS has requested that DOE remove this requirement from the standard, asserting that it serves no safety-related function. At year's end, DOE was considering the RFETS proposal and other options for addressing this issue.

Largely as a result of problems experienced with the RFETS prototype, DOE is moving to less-automated systems for the other sites. The Board's staff has actively encouraged DOE to incorporate lessons learned from the prototype unit into the procurement of follow-on units for SRS, LLNL, and the Hanford Site.

Plutonium Storage and Stabilization at the Savannah River Site

DOE had planned to ship stabilized plutonium metal and oxide from the Hanford Site and RFETS and store them in two SRS facilities—APSF and the K-Area Material Storage (KAMS) facility. Numerous reviews by the Board and its staff have focused on the planning, design, and safety analyses for these two facilities. At the end of 1998, SRS had an essentially complete design for APSF and was starting modifications to the existing K-Reactor building for KAMS. While SRS made much progress on KAMS during 1999, work on APSF was halted with indications that the program had been canceled. This situation adversely impacts SRS-related commitments under Recommendation 94-1 since APSF was intended not only to store, but also to stabilize and package SRS materials by May 2002.

KAMS is scheduled to begin receiving RFETS material in February 2000. During 1999, DOE completed the first of two phases of preparing KAMS and conducted an ORR. KAMS resides in a 45-year-old reactor building (105-K). Its safety posture is dependent on high-quality containers that provide multiple barriers to release. The building no longer provides confinement, but does protect against external hazards, such as tornadoes and earthquakes. Internal hazards (e.g., fires, criticality) are addressed by new fire walls, the container design, and other design features and controls. Since KAMS will not provide any capability to open or repackage containers, a container surveillance program and a planned method for dealing with a damaged container appear warranted, but they do not yet exist. DOE has stated that KAMS will be used for interim storage for up to 10 years, until the containers can be moved to APSF or otherwise dispositioned. Because of delays with APSF and with the proposed plutonium disposition facilities, the Board believes that KAMS may be required for a longer period and that facility redesign should be structured accordingly.

As noted earlier, in February 1999, DOE decided to defer APSF construction, primarily because of higher cost estimates and insufficient allowance of funds for contingency, and began demobilizing the project. This decision had a broad effect not only on material stabilization at SRS, but also on the planned consolidation of plutonium storage at SRS from other sites (particularly Hanford) and on the design of plutonium disposition facilities which, at that stage, were dependent on APSF features.

In a March 1999 letter to the Board, DOE stated that it was prudent to halt the APSF project, given significant increases in the estimated construction costs and DOE's decision to designate SRS as the preferred location for plutonium disposition facilities. In addition, DOE stated that a systems engineering study would be performed that would consider the benefits available through sharing functions with the plutonium disposition facilities. Later in the year, however, DOE decided not to pursue such efficiencies, and began to revise the designs of the disposition facilities to make them independent, as discussed in the *Final Environmental Impact Statement for Surplus Plutonium Disposition* (November 1999). In a May 14, 1999 letter to the Secretary of Energy, the Board reiterated its belief that the APSF functions are vital to SRS stabilization activities, as well as to complex-wide efforts to consolidate plutonium storage in modern, safe facilities at sites with enduring missions. The Board observed that the decision not to pursue APSF construction appeared to have been made already in advance of engineering evaluations.

In July 1999, DOE informed the Board that it was deferring the decision on how plutonium would be stabilized and packaged at SRS. Instead, DOE began the conceptual design for a stabilization and packaging system to be installed in an existing, 1950s-vintage, contaminated building (235-F). DOE indicated that a decision regarding use of this system could be made in July 2000 after the design is 35 percent complete, and that if pursued, this option would support stabilizing and packaging SRS plutonium by July 2006 (i.e., a 4-year delay beyond earlier schedules). In October, DOE expanded the scope of this study to include increased storage in 235-F and KAMS to consolidate storage of plutonium from other sites, such as Hanford, in these aging SRS facilities. In the case of 235-F, however, adding the storage mission to planned stabilization and packaging would introduce inefficiencies. Preliminary estimates indicate that doing so could delay completion of stabilization and packaging of SRS materials until beyond 2008. This would amount to a 7-year deferral of the commitment in DOE's current Implementation Plan for Recommendation 94-1 (i.e., May 2002).

As 1999 closes, it appears that the DOE strategy is likely to result in substantial delays in stabilization and packaging of SRS materials. Furthermore, it is likely that pursuing the 235-F/KAMS option could result in less useful facilities with less remaining service life, but with a cost comparable to that of a new facility, such as the APSF design of a year ago. To date, DOE has not committed to the out-year expenditures needed to either build a new facility or modify an existing one. As a result, SRS is exploring other options, not involving capital expenditures for stabilizing SRS materials. DOE has informed the Board to expect a new strategy in April 2000. The Board continues to follow developments in this area.

Plutonium Stabilization at Hanford

The current mission of the Plutonium Finishing Plant (PFP) is storage of plutonium, stabilization of plutonium-bearing materials, and ultimately, transition to deactivation. PFP contains approximately 3 metric tons of plutonium that is included in the safety issues in the Board's Recommendation 94-1. Most of these materials are stored in forms or configurations that are not suitable for long-term storage. Throughout 1999, the Board urged DOE to accelerate plutonium stabilization at PFP while continuing to ensure that operations are conducted safely. Following a 2-year stand-down due to repeated instances of poor conduct of operations, PFP resumed thermal stabilization of high-purity plutonium oxides in January 1999. On March 3, 1999, the Board transmitted a letter to DOE expressing concern that preparations for these operations were not adequately thorough and systematic. The Board issued a letter to DOE on May 26, 1999 urging DOE to aggressively implement the magnesium hydroxide precipitation process for solution stabilization and to resolve seismic issues associated with startup of the prototype vertical calciner. Stabilization of a small volume of pure plutonium nitrate solutions using the prototype vertical calciner began in September 1999.

The technical staff also held several meetings with DOE-Headquarters, the DOE Richland Operations Office, and PFP contractor personnel to discuss PFP's commitments in the forthcoming Revision 2 to the Implementation Plan for Recommendation 94-1. The Board believed that some of the proposed changes involved imprudent and excessive delay, notably (1) a 19-month delay in completing polycube stabilization, and (2) significant delays in completing packaging of plutonium metal and oxides for long-term safe storage, resulting from the plan's reliance on early shipment of materials to SRS. The early shipment is no longer possible because of the delay and likely cancellation of APSF construction. In response to the Board's concerns, the PFP contractor proposed modifications to PFP's vaults to accommodate the long-term storage containers for plutonium, thus eliminating the reliance on early shipment to SRS; in addition, DOE made a tentative commitment to restore the previously committed schedule for polycube stabilization.

The proposed revision to the Implementation Plan for Recommendation 94-1 now defines milestones for achieving stabilization and safe long-term storage of all plutonium-bearing material at PFP by May 2004. However, the aggressiveness of the completion dates proposed in the revised Implementation Plan is questionable, and the Board has continued to encourage improvements in that area. At the urging of the Board and its staff, PFP recently committed to initiatives that will further accelerate stabilization, including a 300 percent increase in allowable charge size for thermal stabilization of oxides and startup of three additional muffle furnaces for thermal stabilization operations months ahead of the original estimates.

Plutonium Stabilization at RFETS

Within the DOE complex, the most substantial quantity of residues resides at RFETS. As noted previously by the Board, expeditious disposal of low-risk residues at WIPP would satisfy the intent of Recommendation 94-1. RFETS continued its characterization program and—with the agreement of the Board—determined that certain salt, combustible, and crucible residues fell

in the low-risk category. In response to Recommendation 94-1, the following risk reduction activities were accomplished at RFETS during 1999:

- ! Processed more than 6 metric tons of salt residues,
- ! Processed more than 7.5 metric tons of ash residues,
- ! Processed more than 8 metric tons of wet combustible residues, and
- ! Processed more than 12 metric tons of dry residues.

Most of the processing consisted of repacking low-risk materials for shipment to WIPP. To resolve issues related to plutonium dispersibility raised by the Board's Recommendation 94-3, DOE is repackaging dispersible residues into robust containers (pipe overpack containers) pending their shipment to WIPP.

Where they continue to exist, plutonium-bearing solutions present a significant hazard due to the potential for spills and inadvertent criticality. The Board has strongly encouraged DOE to process its inventory of plutonium-bearing solutions to a more stable form. During 1999, RFETS continued to make progress in stabilizing its plutonium-bearing solutions and has now completely drained the solutions from Building 371 and stabilized more than 3500 liters of solution. The site has now processed all of its solutions except for a small quantity held in piping and tank heels in Building 771. These solutions are being addressed during deactivation of the building. The Board's staff encouraged DOE to address plutonium-bearing systems early during Building 771 deactivation. DOE agreed and has now drained 10 systems containing plutonium-bearing solutions, surpassing the Recommendation 94-1 commitment for FY 1999.

Stabilization of Surplus Plutonium Pits

The mission of the proposed Pit Disassembly and Conversion Facility (PDCF) is to disassemble surplus pits and convert them to unclassified oxide for use in mixed-oxide fuel. DOE plans to disassemble and process up to 35 metric tons of plutonium pits within a 10-year period. The Board's staff met with the staff of DOE's Office of Fissile Materials Disposition to discuss important design issues for PDCF, such as the facility hazard category; seismic performance category; classification of structures, systems, and equipment; hazard analysis; and incorporation of the Nuclear Regulatory Commission licensing standards into the design. The staff also held preliminary discussions on the geotechnical aspects of PDCF, the safety classification of fire protection equipment, and ventilation system design.

4.1.2 Enriched Uranium

Highly Enriched Uranium Solutions at SRS

SRS is currently storing 230,000 liters of HEU solution in tanks outside H-Canyon. If stabilization of HEU solution does not begin in a timely manner, continued operations at

H-Canyon will result in a potential shortfall in tank storage of more than 100,000 gallons by 2002. If this problem is not resolved, H-Canyon operations may need to be curtailed. Furthermore, continued accumulation of HEU solutions at SRS will require continued reliance on single-walled, seismically vulnerable tanks in outdoor facilities. The potential exists for an inadvertent transfer, equipment degradation and failure, or chemical reactions that could result in an inadvertent criticality or compromise barriers to release.

The Board has been closely monitoring disposition plans for these solutions. The Board's staff visited SRS in February 1999 to review the hazards of continued storage of the solutions and evaluate DOE's plans for their stabilization. DOE intends to blend down the HEU solutions to low-enriched uranium (LEU) solutions and transfer the material to a vendor designated by the Tennessee Valley Authority (TVA) for use in the manufacture of commercial reactor fuel. DOE plans to transfer the uranium solutions by spring 2003, assuming timely development of an interagency agreement. However, this proposed schedule could be delayed as a result of increased project costs and a lack of funding.

In a letter dated January 28, 1999, which conditionally accepted Revision 1 to the DOE Implementation Plan for Recommendation 94-1, the Board asked DOE to develop a contingency plan for use in the event that an agreement with TVA is not reached within the time frame established in the Implementation Plan. DOE recently initiated action to identify possible alternatives to the TVA scenario, including downblending the solution to 1 percent uranium-235 in HA-Line and converting it to oxide in FA-Line. However, plans and schedules for implementing this contingency plan are not fully developed. The Board will continue to press DOE to eliminate these continuing uncertainties and stabilize these solutions.

4.1.3 Uranium-233

Uranium-233 (U-233) is a man-made isotope of uranium which contains varying quantities of Uranium radioactive. Most of this material is stored at ORNL and INEEL, with a smaller quantity at LANL. The Board DOE to characterize, stabilize, and safely store its U-233 materials. Because most of the U-233 has not been as to the safety of its current storage condition.

During 1999, the Board conducted extensive reviews of ORNL's preparations for its U-233 inspection program. As a result of these reviews, DOE has made a number of safety improvements. The improvements included (1) implementing increased controls against the possibility of a hydrogen explosion when vaults are opened to access the U-233 stored within, (2) improving the radiation protection plan for the inspection program, and (3) developing specific inspection criteria. The Board's staff also identified the need for modifications to ventilation systems to limit the potential spread of U-233 contamination from the handling of containers during the inspection program. The staff found that improvements were needed as well in the equipment used for handling U-233 containers, and that the ORNL contractor needed to improve its conduct of operations significantly, particularly in the areas of formality of test controls and use of procedures. Subsequently, on October 12, 1999, DOE implemented a 30-day pause, followed by a DOE peer review to reassess the safety, scope, and approach of the U-233

inspection and repackaging program. The Board now understands that initial U-233 inspection operations will not commence until the latter part of 2000.

In response to a letter from the Board dated December 14, 1998 providing comments on the draft U-233 storage standard, INEEL inspected one 55-gallon drum containing U-233 fuel materials. INEEL found that, contrary to previous reports, the fuel pins and fuel pellets were not wrapped directly in plastic. The U-233 fuel materials and the containers (including plastics within the drum) showed no significant degradation or pressurization, providing some confirmation that the sintered fuel pellets are remaining stable in storage.

Also in response to the Board's December 14, 1998 letter, DOE has significantly improved the draft U-233 storage standard and has conducted research and development to bolster the standard's technical basis. More significant, DOE revised the standard to be more consistent with the requirements for plutonium storage, including the use of two nested welded containers.

In accordance with its commitment in response to Recommendation 97-1, LANL recently moved U-233 material from the Critical Experiments Facility (Technical Area 18) to a more robust vault with filtered ventilation in the Chemistry and Metallurgy Research Facility. LANL has also initiated plans to ship the U-233 to ORNL for long-term storage. However, ORNL's U-233 is stored in Building 3019, part of which was constructed during the Manhattan Project. The Board's staff recently conducted reviews of the fire protection and ventilation systems of Building 3019. ORNL is in the early stages of completing a new Safety Analysis Report, a requirements analysis for the ventilation system, a fire hazards analysis, and a seismic analysis for the building. The completion of all these actions is required to identify upgrades needed to support safe long-term storage of U-233 within Building 3019, or to enable a decision as to whether the U-233 material needs to be stored in a more modern facility.

In 2000, the Board and its staff will continue to review DOE's actions aimed at achieving readiness to safely conduct the U-233 inspection program at ORNL, finalize the U-233 standard, and develop a path forward for safe long-term storage of U-233 at ORNL.

Oak Ridge Molten Salt Reactor Experiment

The Board continued its oversight of the stabilization and removal of uranium fluoride gases from the Molten Salt Reactor Experiment at ORNL, which is being carried out in accordance with Recommendation 94-1. The successful removal of reactive gas (primarily fluorine and uranium fluoride) from the head spaces of drain tanks and from off-gas system piping reduced the total amount of U-233 remaining in the system from more than 37 kg to less than 15 kg. Preparations to remove U-233 deposits from the Auxiliary Charcoal Bed were delayed because of technical problems associated with the discovery that the bed charcoal was no longer in an easily removable (i.e., granular) form. The Board's staff will follow the readiness review for removal of uranium deposit and assess the results in 2000. Subsequent risk reduction activities include removal of fuel and flush salt from the drain tanks, and stabilization/conversion of uranium salts to oxides.

4.1.4 Special Isotopes

Americium/Curium Solutions

In Recommendation 94-1, the Board recommended expediting the stabilization of americium/curium solutions stored in F-Canyon at SRS. In 1999, SRS completed 35 percent of the conceptual design of a coupled induction melter system for the americium/curium solutions. Review of the design by the Board's staff found that essential requirements for safety had been adequately considered. Although DOE provided funding to allow early design work to proceed in 1999, there will be a significant funding shortfall in FY 2000 and FY 2001. In an attempt to defer costs, DOE issued a request for proposals from industry to design, construct, and test the melter systems. This action may allow work to proceed in the near term, but the effort could stall again in the future unless additional funding or cost efficiencies are identified. The Board believes it is important to expedite this project to eliminate the significant hazard posed by the americium/curium solutions, and is continuing to pursue this issue with DOE.

Neptunium Solutions at SRS

SRS has 6,000 liters of neptunium-237 nitrate solution in tanks in H-Canyon. DOE plans to stabilize this material by firing it to an oxide in the HB-Line facility. A decision on its ultimate disposition has been delayed until DOE's Office of Environmental Management and Office of Nuclear Energy reach agreement on the stabilization of this solution and its transfer from the site. The Implementation Plan for Recommendation 94-1 committed DOE to stabilizing and packaging the neptunium by December 2002. A subsequent revision of this date to September 2003 was accepted by the Board. However, funding shortfalls and personnel shortages have again delayed activities at HB-Line by at least a year. DOE now estimates that HB-Line, Phase II, can start up in December 2001 and begin processing 34,000 liters of plutonium solutions that also remain in H-Canyon. After this processing campaign, HB-Line Phase II could switch to the neptunium solutions in FY 2003 or later. The Board is continuing to press DOE to identify the resources needed to stabilize these solutions expeditiously.

4.2 STABILIZATION OF SPENT NUCLEAR FUEL

DOE's spent nuclear fuel program encompasses coordination of activities at the various DOE sites involved in placing spent nuclear fuel into safe interim storage. An additional goal of this program is to ensure that the canisters used for interim storage can be used for shipment to and burial at a national repository without repackaging. During 1999, the Board's staff worked with DOE's staff to emphasize coordination of spent fuel storage activities at the Hanford Site, SRS, and INEEL.

4.2.1 Hanford Site

Reviews by the Board and its staff identified shortcomings in the SNFP at the Hanford Site K-Basins. These shortcomings included a continued lack of sound project management,

poor implementation of quality assurance requirements, and continuing difficulty in resolving emerging technical issues in a timely manner.

Since 1998, the Board and its staff had been urging that the new containers for storing the spent fuel be code-stamped to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The project has successfully contracted for these containers from a certified supplier at competitive prices. This is expected to ensure enhanced quality to support ultimate disposal in a planned repository.

During 1999, the project discovered that if a postulated drop of a loaded spent fuel cask in the water-filled basin occurred, it could damage the pool to such an extent as to cause an excessive leak of radioactivity into the ground and potential contamination of the nearby Columbia River. The Board and its staff reviewed the planned system modifications and urged a simple concept for resolution of this issue. As a result, additional actions are being taken to minimize the likelihood of a cask drop event and to provide a means for stopping a leak should one occur. Also as a result of discussions with the Board's staff, DOE accepted the need for a diesel generator to provide power for safety-significant electrical loads in the event of a loss of power.

A review by the Board's staff of the experimental data developed by the SNFP to confirm the oxidation rate of irradiated N-reactor fuel revealed that test data with extremely high oxidation rates had been discarded as erroneous. The apparent high rates could, however, have been due to crumbling of the solid fuel pieces and the generation of a large amount of reactive surface area. At the urging of the Board's staff, the project evaluated this phenomenon and concluded that crumbling of irradiated uranium metal is realistic, and should be evaluated for potential impact on the existing safety bases for operations.

4.2.2 Savannah River Site

In a technical report issued by the Board (DNFSB/TECH-7, *Stabilization of Deteriorating Mark 16 and Mark 22 Aluminum-Alloy Spent Nuclear Fuel at the Savannah River Site*), the technical rationale was established for using chemical separation to stabilize the deteriorating defense-related spent nuclear fuel stored in the basins at SRS. During 1999, spent nuclear fuel elements continued to be processed in the H-Canyon. To date, 492 of the 1883 Mark 16 and Mark 22 assemblies have been processed. However, processing was stopped in September 1999 because of delays in starting second cycle operations in H-Canyon. Resumption of stabilization activities is now expected in April 2000. Mark 16 and Mark 22 processing produces highly-enriched uranium solutions that are stored in H-Area awaiting a disposition path (see Section 4.1.2). Tank storage limitations in H-Area may require that spent nuclear fuel processing be curtailed prior to completing this campaign. If the highly-enriched uranium solutions are dispositioned as planned, Mark 16 and Mark 22 processing is now expected to be complete by December 2003.

A large inventory of non-defense-related, aluminum-alloy spent fuel is also in wet storage in defense nuclear facilities at SRS. This inventory will continue to increase as additional fuel is received from off-site research reactors and other DOE sites. This fuel cannot

be left in wet storage indefinitely, and will likely require treatment before ultimate disposal. In a draft Environmental Impact Statement (EIS) issued in December 1998, DOE identified a new technology (the melt and dilute process) as the preferred alternative.

There are potential safety risks associated with the melt and dilute process. The process would involve molten, highly-enriched spent nuclear fuel elements and volatilized fission products without the benefit of a canyon structure for confinement. In addition, fuel melting operations could result in significant contamination of the facility that could impact equipment operation and maintenance and introduce new challenges for the ultimate decommissioning of the facility.

The Board issued a technical report in February 1999 (DNFSB/TECH-22, *Savannah River Site Spent Nuclear Fuel*) that identifies the risks associated with developing this technology and recommends using existing stabilization and processing capability at SRS (i.e., H-Canyon). The draft EIS noted that the melt and dilute process could be implemented by 2005. Current estimates have slipped this date to at least 2008, and additional delays are likely for implementing a new processing technology. The Board will continue to monitor DOE's progress in choosing and safely implementing a spent nuclear fuel processing technology.

In 1997, the Board suggested that continued future operation of F- and H-Canyons would require resolving several safety issues associated with the canyon's exhaust system, electrical equipment near its diesel fuel tank, control room fire hazards, firewater supply piping, emergency power systems, diversion valves, and lightning protection systems. DOE committed to resolve these issues. However, the long-term resolution of several of these issues required completion of the canyon upgrade project which would return critical portions of the F- and H-Canyon exhaust systems and their auxiliary equipment to acceptable reliability.

The Board's staff has been closely following the upgrade project during the past two years and has identified additional issues, including cable aging, diesel generator loading, coordination of protective devices, and compliance with the Institute of Electrical and Electronics Engineers (IEEE) standards. DOE has designed and is completing installation of new safety-class power systems at F- and H-Canyons that comply with relevant safety-class IEEE standards. DOE is also working to resolve other open issues, including contamination control procedures, seismic adequacy of ventilation duct supports and circuit breakers, compliance of the installation of the station batteries to relevant industry standards, and adequacy of missile barriers to protect building openings.

4.2.3 Idaho National Engineering and Environmental Laboratory

The Implementation Plan for Recommendation 94-1 committed DOE to removing fuel from an underwater storage basin for spent fuel (the CPP-603 Basin) at INTEC, by December 2000, because of concerns regarding storage conditions. DOE has met its milestones to date; however, problems with conduct of operations, as well as delays in availability of lifting gear and development of production-mode testing equipment for determination of moisture in fuel pins removed from the Experimental Breeder Reactor (EBR-II), have caused a change in plans for fuel movement. Current plans call for direct transfer of the EBR-II fuel from CPP-603 to

CPP-666, a state-of-the-art fuel storage basin, without determination of the moisture levels, since the fuel will be transferred to Argonne-West for treatment prior to disposal. Approximately 143 fuel units were removed from the CPP-603 Basin during 1999, leaving only 86 units to be transferred in 2000. The Board and its staff will continue to review these activities to ensure that they are performed in a timely and safe manner.

4.3 STORAGE OF HAZARDOUS MATERIALS

Since ultimate disposition of most legacy materials is many years away, it is important to ensure that these materials are adequately and safely stored in the interim. During recent years, the Board has issued several recommendations intended to upgrade storage conditions for these materials, and the Board continues to review new storage areas and evaluate existing storage conditions.

4.3.1 Building 371 at the Rocky Flats Environmental Technology Site

The Board issued Recommendation 94-3, *Rocky Flats Plutonium Storage*, to ensure that the large quantity of special nuclear materials at RFETS would be safely stored. The Board recommended that DOE take a systematic approach to evaluating the suitability of Building 371 for the proposed new mission of storing the site's entire special nuclear materials inventory, and prepare a program plan for building upgrades and improvements consistent with the building's mission. In response, DOE determined that upgrades to structures, systems, and components of Building 371 were needed, as well as to its safety basis. The Board and its staff followed DOE's progress closely and were instrumental in leading DOE to take a systems engineering approach to evaluating and developing upgrades, as well as integrating this approach into project management. Without the Board's intervention, these evaluations would not have been completed in a timely manner.

In May 1999, the Board's staff reviewed progress on the final phases of the Board's Recommendation 94-3. The upgrades to Building 371 required to ensure safe storage have been satisfactorily completed, and a new safety basis has been implemented. Recommendation 94-3 has enhanced the ability to store material safely at the site. These enhancements include the following:

- ! Modification of the building structure to make it more robust, increasing its ability to withstand natural phenomena.
- ! Modifications of the safety system that protects the air filters in the ventilation system to better ensure that fires would not cause a breach in filters that could lead to a release of plutonium contamination from the building.
- ! Addition of an air filtration system to the ventilation supply system to prevent the release of plutonium contamination in the event of a large fire in the building.

- ! Storage of dispersible materials in more robust containers to minimize the potential for release of these materials.
- ! Updating of the safety basis for operations in the building to ensure that necessary safety systems were clearly identified, maintained, and operated to prevent or mitigate the consequences of potential accidents.

On the basis of these accomplishments, the Board closed Recommendation 94-3 on May 27, 1999.

4.3.2 Storage of Uranium Hexafluoride

Approximately 55,000 cylinders containing more than 500,000 metric tons of depleted uranium hexafluoride (UF_6) from the production of enriched uranium for both defense and civilian purposes are stored outdoors at gaseous diffusion plants in Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. In early 1995, the Board found that the corrosion-resistant coatings of the cylinders had not been maintained, and that many cylinders were being handled and stored under conditions that could lead to an increased possibility of breaching of the cylinders. In May 1995, the Board issued Recommendation 95-1, *Improved Safety of Cylinders Containing Depleted Uranium*, recommending that DOE (1) begin an early program to improve the corrosion resistance of the cylinders, (2) evaluate additional measures that would protect the cylinders from corrosion, and (3) determine the proper form for long-term storage of UF_6 . Since then, DOE has taken substantial actions to slow the degradation of cylinders from external corrosion.

In November 1999, the Board was briefed by the Director of the Office of Nuclear Energy, Science and Technology and his staff on the status of the implementation of Recommendation 95-1. The Board was particularly impressed by DOE's use of the systems engineering process to develop a workable and technically justifiable program for management of cylinders, which is now being used to govern the maintenance and surveillance of the cylinders. Although concerned that funding was not available for painting of cylinders during 1999, the Board was pleased that DOE has committed to continuing implementation of the cylinder management program as part of its accelerated program to convert these materials to a stable form.

In recognition of DOE's progress and the completion of all DOE commitments, Recommendation 95-1 was closed on December 16, 1999. Nevertheless, the Board will continue to monitor the long-term storage of the cylinders and the eventual conversion of the depleted UF_6 .

4.4 WASTE MANAGEMENT

In keeping with the Board's statutory mandate to ensure the establishment of appropriate safety standards for DOE's activities, the Board has consistently emphasized the importance of finalizing and issuing DOE Order 435.1, *Radioactive Waste Management*. As a result of the

Board's continuing attention to this issue, the Order was issued on July 9, 1999, and is expected to be fully implemented by July 9, 2000. The final Order reflects numerous safety-related provisions that resulted directly from the Board's extensive review of the proposed requirements, and incorporates the safety-related measures of Recommendation 94-2. The Order addresses three major waste types—high-level, transuranic, and low-level waste—and the safety requirements for design, construction, operation, and decommissioning of associated facilities. The following subsections address, for each of these waste types, those activities in defense nuclear facilities essential for the protection of the health and safety of the public.

4.4.1 High-Level Waste

Idaho National Engineering and Environmental Laboratory

Processing of liquid waste at the INTEC at INEEL is driven by the requirements of the Settlement Agreement entered into by DOE, the U.S. Navy, and the State of Idaho in October 1995. To reduce the risks associated with long-term storage of high-level waste in tanks at INTEC, INEEL calcines the liquid waste in the New Waste Calcining Facility and stores this solidified product in on-site bins. In addition, a high-level waste evaporator was constructed and operated to reduce the volume of liquid waste to be stored prior to calcination.

All non-sodium-bearing waste was calcined by June 1998, leaving only sodium-bearing waste, which is more difficult to calcine. By February 1999, INEEL was able to satisfy the environmental requirements of the State of Idaho and the U.S. Environmental Protection Agency for characterizing the atmospheric effluents from the calciner so that calcining of sodium-bearing waste at elevated temperatures could be initiated. However, operational upsets caused the calciner to be shut down in May 1999. Approximately 1.3 million gallons of sodium-bearing waste remains in tanks awaiting processing. Some of this liquid waste is in tanks that are vulnerable to earthquakes. While INTEC plans to resume calciner operation in January 2000, the ultimate disposition of the sodium-bearing waste will be decided by the outcome of an EIS issued for public comment at the end of 1999, followed by a record of decision in the spring of 2000. The Board will review the results of these evaluations when they become available.

During 1999, several reviews of INTEC were conducted by the Board's staff. Problems were identified in work planning and the safe conduct of work. These problems have been identified to DOE for corrective action. The Board and its staff will continue to oversee operations at INEEL and work with DOE to ensure that safety is paramount in operations at those facilities under the purview of the Board.

Savannah River Site

In-Tank Precipitation Facility. The In-Tank Precipitation (ITP) facility at SRS was intended as a pretreatment facility for use in concentrating and removing radioactive fission products from high-level waste liquids. The separated fission products would have been processed at the Defense Waste Processing Facility. The decontaminated liquids would have been processed at the Saltstone Production Facility. Chemical and radiolytic decomposition of the tetraphenylborate precipitating agent occurs during the ITP process, generating substantial

quantities of benzene, a flammable and carcinogenic gas. If the accumulated precipitates were to decompose rapidly, the resulting benzene release could be very large, posing a major flammability hazard. The Board's Recommendation 96-1, *In-Tank Precipitation System at the Savannah River Site*, was issued in August 1996 to ensure that the hazards associated with the ITP process would be adequately understood and controlled before the ITP Facility commenced operations. Laboratory experiments carried out in response to Recommendation 96-1 confirmed the Board's concerns and led DOE to conclude early in 1998 that the ITP process could not be operated safely without significant upgrades to the ITP Facility. As a result, DOE has halted efforts to begin operations at the ITP Facility, and alternatives to the ITP process are under evaluation.

The Board has carefully reviewed the methodology DOE is using to evaluate alternative waste treatment technologies, as well as the results of these evaluations. DOE began with a wide variety of candidate technologies and systematically reduced the field to four finalists: small-scale tetraphenylborate precipitation, nonelutable ion exchange, caustic-side solvent extraction, and direct grouting of tank liquids without cesium removal. The Board agrees that each of these options could be carried out safely, but each also has its strengths and drawbacks. Notable drawbacks include the need to deal with benzene in downstream facilities for the small-scale tetraphenylborate option, the large radiological source term of the loaded nonelutable exchange media, the immaturity of the caustic-side solvent extraction process, and the on-site disposal of large quantities of radioactive cesium for the direct grouting option. DOE has not yet decided how to proceed from this point, and it is not clear when DOE will choose a primary option. Immobilization of high-level waste at SRS remains one of the Board's highest priorities, and the Board will continue to review DOE's efforts to select a safe and effective process to replace ITP.

High-Level Waste Facilities. A major activity of the Board in 1999 was the review of DOE's preparations for startup of the new replacement high-level waste evaporator in the SRS H-Area tank farm. The new evaporator is needed to concentrate high-level waste from the H- and F-Canyons at SRS, as well as liquids generated by washing of high-level waste sludge and by the Defense Waste Processing Facility. A review by the Board's staff of the engineered and administrative controls designed to prevent or mitigate postulated accidents revealed several safety issues regarding implementation of controls. For example, the system to control the evaporator level does not meet the requirements for a safety-class system, and the proposed controls do not adequately ensure that waste would be removed from a shut-down evaporator in a timely manner to prevent a potential hydrogen explosion. Subsequent discussions with site personnel led to a satisfactory plan for improvements to address all of the identified safety issues.

The Board's staff also observed the contractor's and DOE's ORRs for the evaporator. Based on observation of the contractor's ORR, the Board's staff concluded that the ORR began prematurely and was used inappropriately as a means of achieving readiness, rather than confirming it. This problem is frequently observed in the DOE complex, and the Board will continue to emphasize to DOE that better preparations are needed before commencement of readiness reviews. The staff also noted that the plan and procedures for the phased startup of radioactive operations had not been completed, and that these items are key to ensuring a safe, controlled startup of the facility. The subsequent ORR by DOE confirmed these findings. The

Board will review the startup plans and procedures once they have been completed, and will provide close oversight of the commencement of radioactive operations at the facility.

Hanford Site

Characterization of High-Level Waste in Tanks. The system for storage, retrieval, processing, and immobilization of the high-level waste currently in 177 underground storage tanks at the Hanford Site has consistently been one of the Board's top priorities. The Board issued several recommendations between 1990 and 1993 regarding the safe storage and characterization of the wastes, as well as the need to use an effective systems engineering approach in the development of waste disposal facilities. Continued attention to these matters by the Board resulted in the institutionalization of the tank characterization program and the development and implementation of controls to ensure that the wastes remain safely stored.

As a result of the progress made in the characterization of high-level tank wastes, the Board closed Recommendation 93-5, *Hanford Waste Tanks Characterization Studies*, on November 15, 1999. In responding to Recommendation 93-5, DOE has completed core sampling of 132 of the 177 tanks and performed a tank-by-tank evaluation of the remaining tanks to ensure that adequate characterization information is available to ensure continued safe storage without further sampling. DOE has removed the high-heat sludge that was inappropriately stored in Tank C-106 and transferred it to a tank designed for the storage of such waste. Finally, DOE has resolved safety issues associated with nuclear criticality, flammable gases, and potentially hazardous organic complexants and ferrocyanide compounds, and has developed and begun operating in accordance with an updated tank farm authorization basis document that takes into account the information gathered under the characterization program responding to Recommendation 93-5.

In closing Recommendation 93-5, the Board recognized that considerably more characterization information is needed to support the programs that will ultimately dispose of the Hanford tank wastes. The Board therefore strongly encouraged DOE to maintain the existing infrastructure supporting characterization, with particular emphasis on retention of technically competent staff and continued use of the systems engineering architecture developed for the waste disposal programs.

High-Level Waste Tank SY-101. In late 1997, DOE discovered that the waste level in Tank SY-101 had risen 2 to 4 inches during the year. Subsequently, the level continued to rise, and DOE discovered that, as a result of the formation of a crust layer, flammable gas was being trapped in the upper region of the waste. These changes in gas retention behavior have not resulted in new credible mechanisms that could cause gas accumulating in the vapor space in the tank to reach flammable concentrations. However, DOE has determined that the increased volume of flammable gas stored within the tank represents an unacceptable risk. Applying information gained from its tank waste characterization program and using the systematic approach developed in response to Recommendation 92-4, DOE methodically investigated this phenomenon and developed a plausible explanation and plans for remediating the situation.

DOE's existing plan involves a series of transfers and dilutions of waste in Tank SY-101 to facilitate destruction of the crust and controlled release of gases. DOE designed, constructed, and installed a system of pumps and transfer lines and on December 18, 1999, successfully transferred 89,500 gallons of Tank SY-101 waste into Tank SY-102. Following this transfer, dilution water was also successfully added to Tank SY-101 in preparation for the next transfer. In addition, DOE met its objective of safely releasing a portion of the flammable gas trapped in the tank. The Board closely evaluated these activities and is continuing to encourage DOE to proceed with this strategy with the appropriate caution.

High-Level Waste Tank C-106. In late 1998, DOE began the process of removing about 200,000 gallons of high-level waste sludge from a 50-year-old single-shell tank (C-106) and transferring the waste to a double-shell tank (AY-102) that is designed to handle the high heat output of the waste. Tank C-106 had the highest heat content of any single-shell tank at the Hanford Site, and the addition of 6,000 gallons of water each month was required to cool the waste. The removal of waste from Tank C-106 was desirable both to reduce the potential for leakage to the environment and to eliminate the monthly addition of water, which had significantly complicated attempts at sensitive leak detection. The waste is removed via a sluicing process that uses a high-pressure liquid jet and vertical lift pumps to mobilize and retrieve the waste. This is the first attempt to transfer radioactive waste sludge at the Hanford Site since 1978.

Although some difficulties were encountered initially, the transfer of the wastes to Tank AY-102 has been completed. The Board closely reviewed the resolution of issues associated with the release of volatile organic compounds during transfer; the redesign, construction, and replacement of waste transfer lines to eliminate leaks at fittings; the formulation of lessons learned from this project for use in upcoming waste retrieval; and the modeling performed to show that sufficient sludge had been retrieved to ensure the safe long-term cooling of the residual contents of Tank C-106. The Board has encouraged the dissemination of important lessons learned regarding the retrieval system to support further retrieval and disposition of high-level wastes at the Hanford Site. The Board considers the safety issues associated with the high-heat contents of Tank C-106 to be closed and has communicated this conclusion to DOE through closure of Recommendation 93-5.

4.4.2 Low-Level Waste

Recommendation 94-2, *Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites*, called for a complex-wide review of DOE's low-level radioactive waste program to establish the dimensions of the low-level waste problem and to identify suitable corrective actions. By the end of 1998, most of the actions proposed in the recommendation either had been completed or were being addressed appropriately. The remaining open actions included meeting the requirement for development and issuance of additional requirements, standards, or guidance on low-level waste management that would address (1) the safety aspects of the waste form and packaging; (2) siting and performance assessment of sites used in burial of the wastes; and (3) facility design, construction, operation, closure, and environmental monitoring. This action was accomplished through issuance of a new waste management directive, DOE Order 435.1, on July 9, 1999. The two additional

actions necessary for closure of Recommendation 94-2 were (1) evidence of satisfactory progress toward completion of the remaining analyses for comprehensive performance assessment for existing low-level waste burial grounds, and (2) implementation of an acceptable strategy for meeting needs for research and development on outstanding low-level waste. Following completion of these requirements, the Board closed this recommendation in December 1999.

4.4.3 Transuranic Waste

Waste Isolation Pilot Plant

WIPP, located 26 miles east of Carlsbad, New Mexico, is a geologic repository for defense transuranic (TRU) nuclear wastes. The Board has been reviewing the operational safety of WIPP since early 1990. The Board increased such activity in late 1997 in response to DOE's planned mid-1998 startup of WIPP disposal operations. The Board's staff reviewed the WIPP authorization basis documentation, as well as the waste characterization and certification audit process used by the DOE Carlsbad Area Office for the sites expected to make initial shipments to WIPP for disposal. The Board's staff also evaluated DOE's ORR for WIPP, an emergency preparedness exercise, and the safety and reliability of the mine hoist intended for lowering waste below ground for disposal. The Board concluded that WIPP could be operated safely.

On March 23, 1999, WIPP became operational with receipt of the first shipment of TRU waste from LANL. The Board monitored the first receipt and emplacement of waste in March and continued to observe operations during the remainder of the year as the operations progressed with shipments from INEEL and RFETS. The Board will continue to monitor operations in 2000 as WIPP continues to ramp up to its full capacity of 17 shipments per week.

Advanced Mixed Waste Treatment Project

The Advanced Mixed Waste Treatment Project (AMWTP) at INEEL is a privatized activity to retrieve, characterize, treat, and package a large inventory of low-level/TRU waste that originated from defense nuclear facilities elsewhere in the DOE complex. The design is at the 20–30 percent stage, and operations are scheduled to begin by 2003. Questions were raised in a 1998 review by the Board's staff concerning the adequacy of preliminary safety analyses and the identification of structures and systems relied upon to perform safety functions. Three of the four issues (electrical systems, seismic design, and life safety code) are now closed, but the fourth issue, criticality control, requires further review. In addition, the staff is continuing to review a number of issues associated with the authorization basis, controls, and safety systems. Overall, however, the AMWTP design is progressing well.

4.5 DEACTIVATION AND DECOMMISSIONING

A key objective of the Board regarding the hazardous remnants of weapons production is to ensure that DOE is aggressively pursuing the safe decommissioning of defense nuclear facilities that are no longer needed to meet national security missions, and that pose a significant

risk to workers or the public. This objective is achieved by conducting reviews of the following general types:

- ! Evaluating the condition and contents of inactive facilities to determine where more expeditious stabilization actions are required.
- ! Evaluating proposed decommissioning activities and technologies.
- ! Reviewing the application of the principles of ISM to the planning and execution of decommissioning activities.
- ! Observing activities to confirm that decommissioning of nuclear facilities is performed safely.

During 1999, the Board focused its attention on DOE's development of guidance used to implement requirements related to deactivation and decommissioning, and on deactivation and decommissioning activities at RFETS, the Hanford Site, the Y-12 Plant, and the Miamisburg Environmental Management Project (MEMP).⁵ The number of cleanup projects selected by the Board for priority attention, based on the considerations set forth above, is small relative to DOE's total environmental restoration program.

4.5.1 Rocky Flats Environmental Technology Site

In 1999, the Board's staff was involved in several reviews at RFETS associated with the planning and implementation of deactivation and decommissioning activities. Throughout the year, the Board staff followed issues related to the development and implementation of controls for such work.

Building 771

Among DOE's defense nuclear facilities slated for decommissioning, the Board has identified Building 771 (the former Plutonium Recovery Facility) at RFETS as one having the highest priority. Building 771 originally contained more than 50 kg of plutonium held up in gloveboxes, ducts, equipment, plenums, furnaces, tanks, piping, and contaminated rooms or areas. Tapping and draining the piping used for actinide and reagent solutions and cleaning out residual liquids in nominally empty tanks began in 1998 and continued in 1999. The Board encouraged RFETS to begin early to process high-risk systems containing plutonium solutions. The removal and size reduction of gloveboxes began in earnest in 1999. Based on observation of activities at RFETS, the Board became concerned that RFETS tended to rely principally on personal protective equipment (PPE) during decommissioning, rather than using engineered controls that eliminate or mitigate hazards more effectively. In response to the Board's concern, RFETS has embraced the revised goal of dependance on engineered controls, and has expanded the use of such controls to mitigate hazards.

⁵ Formerly referred to as the Mound Plant.

The Board's staff has overseen the development and implementation of engineered controls for size reduction of gloveboxes in Building 771. Weaknesses were noted in systems engineering, integration of safety disciplines during design and systems testing, and the approach taken to achieve worker proficiency. Following discussions with the contractor, some improvements were observed. For example, RFETS decided to provide workers the opportunity to gain proficiency by working on a clean glovebox prior to size reducing radioactively contaminated gloveboxes and before conducting tests. The Board and its staff will continue to closely follow decommissioning activities at Building 771, which are expected to continue through 2004.

Building 779

Decommissioning activities at Building 779 (the former Plutonium Process Development Building), a moderate-risk plutonium facility, began in early 1998 and continued in 1999. Building 779 was the first major plutonium building at Rocky Flats to undergo decontamination and decommissioning. Decontamination, removal of 133 gloveboxes, and removal of plutonium holdup have been completed. Demolition of the structure began in October 1999 and was completed in January 2000.

During 1999, the Board's staff reviewed selected activities within the facility, including removal of gloveboxes and ventilation systems, and structural decontamination. Activities of the Board's Site Representative included numerous walkdowns of the facility to observe operations, follow-up on contamination incidents, attendance at prejob briefs to observe discussions of lessons learned, review of procedures for glovebox size reduction, and assessment of the implementation of radiological corrective actions.

4.5.2 Hanford Site

In 1999, the Board's staff reviewed various deactivation and decommissioning activities at the Hanford Site. The staff performed facility walkdowns, discussed issues with DOE and contractor personnel, and reviewed documents related to safety.

Plutonium Concentration Facility

The U-233-S Plutonium Concentration Facility (233-S Facility) was built in 1955 to further concentrate the plutonium nitrate solution produced by solvent extraction in the REDOX Plant. The 233-S Facility operated until July 1967, at which time the building was added to DOE's program of surplus facility management as a retired facility. An estimated 1.5 kg of plutonium-239 remains in the process portion of the facility. DOE's program for removal calls for dismantlement and disposal of highly contaminated process systems, decontamination and/or stabilization of the facility, then demolition and disposal.

During this year, the staff monitored readiness reviews that were conducted by the contractor and DOE personnel in preparation for work that was to include a major ventilation modification and removal of a hot cell panel, reviewed work planning for various activities associated with deactivation and decommissioning, and reviewed safety basis documents. The

staff has found persistent weaknesses in work planning in the areas of hazard identification and analysis. The staff identified in the safety documentation a significant underestimation of the dispersible plutonium inventory contained in the facility. Although the contractor resisted making changes in the safety basis to reflect this shortcoming, subsequent characterization data confirmed much higher levels of plutonium contamination than had previously been assumed. The contractor has now initiated revisions to the safety basis for the 233-S Facility that will have an impact on hazard controls, procedures, and work activities. The Board has requested that DOE describe actions to correct the programmatic deficiencies that led to this improper hazard identification.

Bulk Reduction Building

The Bulk Reduction Building (224-T), built in the early 1940s as part of Hanford's T-Plant complex, was used to concentrate plutonium solutions. After the process cells ceased operation in 1956, they were sealed and isolated from the rest of the facility. The section including the offices and operating gallery was renamed the Transuranic Storage and Assay Facility (TRUSAF) in 1985, and was used to store drums containing TRU waste. With its mission now at an end, TRUSAF is almost completely empty.

Until recently, no DOE Richland Operations Office or contractor organization acknowledged ownership of the process cells in 224-T, although various organizations were responsible for TRUSAF. No one has entered the process section of the facility for at least 20 years, and contents of the process cells are not well known. On April 15, 1999, DOE's Office of Nuclear Materials and Facility Stabilization and Babcock and Wilcox Hanford Company (now Fluor Hanford) assumed responsibility for the entire facility.

Later in 1999, the Board's staff met with DOE and its contractor to discuss potential safety issues and the status and management of the facility. As a result of these discussions, Fluor Hanford installed monitoring equipment, conducted tests, and completed some safety reviews. These actions addressed some of the staff's concerns regarding the configuration of the ventilation system and hazards of the facility, and the site is continuing to make progress. For example, a schedule for entering portions of the facility to identify hazards has been developed. The Board's staff intends to continue to follow the resolution of the outstanding issues associated with this facility.

Buildings 324/327

Buildings 324 and 327 in the Hanford 300 area are laboratory facilities with hot cells that were used for studies related to waste treatment/immobilization and fuel elements, and examination of radioactive materials. These facilities are only 1.5 miles from the city of Richland, and they represent one of Hanford's major radiological hazards. The primary stabilization activity in Buildings 324/327 is the ongoing cleanout of approximately 550,000 curies of radioactive materials from Building 324. One large hot cell (B-cell) is of special concern because it contains about 120,000 curies of contamination in the form of easily dispersible material. B-Cell is scheduled to be cleaned out by the end of FY 2001.

In January 1999, sparks from a plasma arc torch used to size reduce former processing equipment in B-Cell ignited combustible materials in an open waste container. The resulting fire was extinguished by operators using a manual water spray. The Board's staff held discussions with project personnel following the fire and reviewed the proposed corrective actions. Procedures were changed to require operators to maintain the inventory of combustible material and to place protective barriers that would isolate the materials from any sparks from cutting. The corrective actions have been successful in allowing continued plasma arc cutting to proceed safely.

4.5.3 Y-12 Plant

Building 9206 at the Y-12 Plant is a Hazard Category 2 nuclear facility currently functioning in warm standby as an in-process storage building. There are no plans to restart operations in the building. Many vulnerabilities in the facility have been identified by both the Board and DOE's HEU Vulnerability Assessment of 1996. The facility is being prepared for deactivation, which will involve removing fissile and other hazardous materials (2,600 batches of uranium-bearing material containing 3,200 kg of uranium-235).

In a letter to DOE in February 1998, the Board noted that a lack of attention to the building was causing the hazards and risks associated with the building to increase. Based on a recent staff review, it is apparent that many of the same issues persist almost 2 years later (e.g., insufficient progress toward stabilization of excess in-process material, lack of quantification of holdup). In another letter to DOE in November 1999, the Board reiterated the importance of not allowing the facility and its systems to deteriorate any further, and the need to expedite risk reduction activities. The Board requested that DOE provide a written path forward for proposed risk mitigation. The response provided by DOE in December 1999 did not commit to the timely response needed to address these hazards. The Board is continuing to press this issue.

4.5.4 Miamisburg Environmental Management Project

The mission of MEMP in Miamisburg, Ohio, is cleanup, environmental restoration, and private economic development. The site was built in the 1940s to produce components for nuclear weapons using tritium. In September 1998, a significant milestone was reached at the site when the last quantity of bulk tritium was removed.

The cleanup of the residual tritium and the dismantlement of the facilities and process equipment pose new challenges to the health and safety of the workers performing these activities. During this year, the Board's staff followed technical issues associated with the radiation protection program for work in areas suspected of being contaminated with tritium compounds, such as metal tritides. The MEMP contractor has prepared a corrective action plan in response to the staff's issues.

Because radiation protection measures for metal tritides may be applicable to other DOE defense nuclear facilities, and because some metal tritides and organically bound tritium may behave differently from elemental tritium or tritium oxide, new radiation protection approaches appear to be needed. In a letter to DOE dated April 29, 1999, the Board requested information

regarding a technical position on the approach that should be used, and requested that DOE describe any new requirements, guidance, and compensatory measures that may be necessary. As a result of this action, DOE responded in a letter to the Board dated June 10, 1999, identifying a path forward for evaluating this issue throughout the complex and developing an updated technical approach. DOE committed to taking compensatory measures to remind its sites of the possible presence of metal tritides and organically bound tritium, and to inform them of the technical information about these tritium compounds that is currently available.

DOE has made progress toward meeting its commitments. DOE has determined that there is a need to enhance its policy pertaining to special tritium compounds, and has developed an approach that is expected to lead to the promulgation of needed formal requirements and guidance. In the interim, DOE will work with MEMP and other field organizations to provide the guidance and compensatory measures required to allow needed work to continue. The Board will continue to assess DOE's progress to ensure that decommissioning work at MEMP is supported by adequate technical analysis and controls.

5. ADMINISTRATIVE MATTERS

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5.1 HUMAN RESOURCES

5.1.1 Recruiting of Technical Staff

Each year the Board actively seeks the brightest engineering graduates from colleges and universities across the country, as well as talented engineering professionals who share the Board's dedication and commitment to carrying out its public health and safety mission. The Board's ongoing efforts to recruit individuals of high intellectual caliber and exceptional technical capabilities have enabled it to acquire a staff competent in all major aspects of nuclear safety, with multidisciplinary backgrounds that include extensive experience in nuclear, mechanical, electrical, chemical, and structural engineering, as well as physics and metallurgy. Moreover, most mid- to senior-level technical staff members possess practical nuclear experience gained from duty in the U.S. Navy's 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. Also notable is the fact that three members of the General Counsel's office have technical/scientific degrees in addition to their law degrees, and two are licensed professional engineers.

5.1.2 Statutory Ceiling and Location of Staff

By law, the Board is authorized to hire up to 150 full-time employees. As of December 31, 1999, it had 5 full-time Board Members and 95 full-time staff. The Board plans to staff approximately 10 technical positions within the next year; 3 of the 10 positions are

expected to be entry-level interns who will be part of the Board's 3-year professional development program..

While most of the Board's technical staff operates from offices in Washington, D.C., 10 staff members are located at various DOE field sites. Specifically, there are 2 Site Representatives at the Pantex Plant near Amarillo, Texas; 2 at the Hanford Site in Richland, Washington; 2 at the Rocky Flats Environmental Technology Site near Denver, Colorado; 2 at the Savannah River Site near Aiken, South Carolina; and 2 at the Oak Ridge Site near Oak Ridge, Tennessee. The Site Representatives are aided in their work by regular visits from the Board's Washington-based technical staff, who can and do bring specialized disciplines to assist in solving technical problems.

5.1.3 Continuous Training and Education Levels of Staff

The Board expects its engineers and scientists to maintain the highest level of technical knowledge. Therefore, the Board encourages its technical staff to improve their skills continually through academic means. Currently, 91 percent of the staff hold advanced degrees, of which 23 percent are at the Ph.D. level.

The other technical staff members, all of whom are select college graduates, have been recruited through the Board's professional development program. This program is highly prestigious and fully funded by the Board. Entry-level employees recruited into this 3-year program receive a formal graduate-school education and intensive on-the-job training by experienced technical mentors. Currently, there are three entry-level employees in this program, and by summer 2000, each of these individuals should be awarded a masters degree from an engineering program.

During fall 1999, four employees in the Board's professional development program completed 3 years of training with outstanding academic achievement and on-the-job performance. While this program continues to evolve, at the core it remains an extremely useful recruiting tool in attracting high-quality entry-level engineers and prepares them for challenging assignments in their fields.

5.1.4 Recruitment and Retraining Tools

From its inception, the Board has had specific statutory authority to pay competitive salaries to high-quality candidates interested in filling the Board's technical positions. Other flexibilities include the Board's discretionary authority to offer a recruitment bonus in the form of a lump-sum payment of up to 25 percent of basic pay. In an effort to retain quality employees, the Board has continued its pay-for-performance system. This system gives employees the opportunity to receive cash bonuses and increases in their base pay in addition to promotions. Employees are also provided health and life insurance, and thrift savings and retirement benefits, plus an annual cost-of-living increase in salary. Nonmonetary attractions include family-friendly work options, an alternative work schedule that allows an employee one day off in a biweekly pay period, a metro subsidy, and a fitness facility on site.

5.2 ACQUISITION AND FINANCIAL MANAGEMENT

The Board acquires outside experts to provide a variety of specialized technical expertise in areas such as nuclear weapons assembly and disassembly, plutonium processing, and conduct of operations. This expertise has been, and will continue to be, a valuable resource to the Board in the conduct of its complex and challenging health and safety oversight responsibilities.

In the area of financial management, the Board initiated reviews of its internal controls to ensure that they were effective and were achieving the intended results. Improvements were implemented in selected areas to strengthen the controls. The increased use of electronic payments and reimbursements to employees has resulted in greater efficiencies and higher levels of customer service.

The Board has continued to improve the efficiency of its procurement operations through streamlining initiatives and the expanded use of credit cards for various purchases. Specifically, the number of individuals using credit cards has increased throughout the agency; the result has been more timely and efficient acquisition of goods and services, and a significant reduction in the creation of purchase orders and related paperwork. These initiatives have also included a comprehensive review of internal management controls and resulted in new or revised procedures where appropriate.

5.3 INFORMATION TECHNOLOGY AND SECURITY

5.3.1 Information Technology

To ensure that its information and communications capabilities remain at the highest levels possible, the Board has made necessary upgrades to system hardware and software throughout the year. Several key initiatives were implemented to improve and protect the Board's information technology infrastructure. In addition, the Board initiated a review of all agency information systems to streamline and integrate them to the extent possible.

The Board has begun to use media streaming technology to deliver audio and video information to its staff and the public. The streaming format allows information that was previously available only on videotape to be seen by multiple viewers simultaneously without having to leave their desks. This approach allows the Board to provide richer content to its staff and the public, and will be used in the future to improve the way the Board provides employee training, coverage of public hearings and meetings, and many other business services.

The Board has continued its successful use of video teleconferencing technology for the rapid exchange of information during briefing sessions with multiple DOE field sites on issues that impact the entire weapons complex. This technology enables the Board's Headquarters and field staff to receive briefings from DOE and its contractors with minimal burden to DOE's staff.

5.3.2 Information Security

Recently the Board began a comprehensive review of its information security policies and practices, aimed at improving its security posture in the face of today's rapidly changing threats. By taking a proactive approach to information security, the Board hopes to prevent attacks against its information resources instead of merely reacting to them.

As part of its emergency response capability, the Board has maintained a node connection on the DOE emergency communication network since that program's inception about 2 years ago. This node connection is maintained 24 hours a day. Should an incident occur at a DOE facility, the connection allows for immediate updates and communications.

5.3.3 Preparations for Year 2000

In preparation for the Y2K rollover, the Board developed a comprehensive business continuity and contingency plan. The Board addressed Y2K contingencies both internally and with respect to potential failures at DOE facilities.

5.4 INQUIRIES INTO HEALTH AND SAFETY ISSUES

During 1999, combined teams of legal and technical members of the Board's staff pursued inquiries into health and safety issues at several defense nuclear facilities pursuant to 42 USC § 2286a. Inquiries were conducted at the Rocky Flats Environmental Technology Site, Oak Ridge National Laboratory, the Savannah River Site, the Waste Isolation Pilot Plant, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Idaho National Engineering and Environmental Laboratory. Several of these inquiries produced significant improvements in practices or conditions that involved public health and safety and supported national security missions. Most of the lessons learned and corrective actions resulting from these inquiries had applications throughout the defense nuclear complex.

Through continuing review of DOE's infrastructure for protecting safety-related structures, systems, and components from nonconforming or suspect/counterfeit parts, the Board's staff discovered that DOE failed to respond to an interagency alert issued by the Department of Defense (DoD) regarding suspect/counterfeit electronic components sold to several federal agencies, including DOE. Intervention by the Board's staff included legal, technical, and administrative assistance that enabled DOE to protect potentially compromised missions and to cooperate fully with actions of DoD and the Department of Justice.

DOE subsequently took effective measures to prevent the introduction of suspect/counterfeit parts into applications that could adversely affect worker and public safety and the safe maintenance of the nuclear weapons stockpile. Specifically, with regard to suspect items identified by DoD, DOE technically evaluated the adequacy of the items and provided assurance that they would not compromise safety.

In response to allegations raised by a concerned individual that radiological sources and the use of cargo containers for temporary storage presented safety hazards at the Rocky Flats Environmental Technology Site, the Board's staff conducted an on-site inquiry. The staff found no safety hazards associated with the issues raised by this individual. As a result of inquiries made by the staff, however, weaknesses in the control of radiological sources, cargo containers, and storage conditions for low-level radioactive waste were identified. The DOE Rocky Flats Field Office and contractors have since taken actions to institute effective controls on sources, to improve controls on the use of cargo containers for temporary storage, to reduce the number of cargo containers at the site, and to effectively control storage conditions for low-level radioactive waste.

The Board's staff also conducted reviews at WIPP to thoroughly evaluate allegations of safety deficiencies brought to the Board's attention by anonymous sources prior to the planned opening of WIPP. The staff concluded that the allegations were unfounded and that WIPP was in a condition to be safely operated.

5.5 PUBLIC INTERACTION WITH THE BOARD

Since 1990, the Board has held 71 public meetings at sites across the nation and in Washington, D.C. The Board has found these meetings to be a highly effective tool for encouraging responsiveness on the part of DOE representatives and for exchanging information with state and local officials, labor leaders, DOE facility workers, public interest groups, and area residents. The Board's public reading room is open to the public every working day. The staff has received numerous complimentary letters from private citizens, public interest groups, corporations, and other government agencies on the availability of the Board's technical and administrative documents.

During 1999, the Board conducted four public meetings at its Washington, D.C., office, and one in Richland, Washington. At three of these meetings, the Board and its technical staff reviewed the status of DOE's Implementation Plan for the Board's Recommendation 95-2, *Safety Management*. One public meeting was held to examine DOE's progress on the implementation of Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*. The meeting in Richland, Washington, was held to review the status of DOE's implementation of Recommendations 92-4, *Multi-Function Waste Tank Facility at the Hanford Site*, and 93-5, *Hanford Waste Tanks Characterization Studies*. In addition to these meetings, members of the Board's staff have provided informational briefings to local officials, citizens' advisory boards, and other public interest groups in the vicinity of the Pantex Plant, the Savannah River Site, the Hanford Site, and the Rocky Flats Environmental Technology Site.

Notices of the Board's public meetings are published in the *Federal Register* and are mailed to more than 400 organizations and individuals that have requested to be on the Board's mailing list. In addition, each notice is published in local newspapers serving the communities near the facilities involved, along with being placed on the Board's Internet Web site, located at www.DNFSB.gov.

APPENDIX A. BOARD RECOMMENDATION 99-1

46894 Federal Register / Vol. 64, No. 166 / Friday, August 27, 1999 / Notices

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

[Recommendation 99-1]

Safe Storage of Fissionable Material Called "Pits"

AGENCY: Defense Nuclear Facilities
Safety Board.

ACTION: Notice, recommendation.

SUMMARY: The Defense Nuclear
Facilities Safety Board has made a
recommendation to the Secretary of
Energy pursuant to 42 U.S.C 2286a(a)(5)
concerning safe storage of fissionable
material called "pits."

DATES: Comments, data, views, or
arguments concerning this
recommendation are due on or before
September 27, 1999.

ADDRESSES: Send comments, data,
views, or arguments concerning this
recommendation to: Defense Nuclear
Facilities Safety Board, 625 Indiana
Avenue, NW, Suite 700, Washington,
DC 20004-2901.

FOR FURTHER INFORMATION

CONTACT:

Kenneth M. Pusateri or Andrew L.
Thibadeau at the address above or
telephone (202) 694-7000.

Dated: August 23, 1999.

John T. Conway,
Chairman.

[Recommendation 99-1]

Safe Storage of Fissionable Material Called "Pits"

Dated: August 11, 1999.

Fissionable components are at the heart of all nuclear weapons, and have therefore been of central importance to that part of the nation's defense posture that relies on nuclear deterrence. Most of the defense nuclear programs of DOE and its predecessor agencies have been devoted to production of the fissionable material for these components and the working of this material into weapons parts. Most fissionable material in nuclear weapons is in components called "pits," which are the primary parts of the weapons, and which have geometrical forms, dimensions, and other features which are highly classified. Pits are predominantly made of plutonium metal which by itself would corrode in an air atmosphere, causing a possibility of dispersion of this hazardous material. Therefore, pits normally have a corrosion-resistant cladding, and where possible they are kept in an inert atmosphere. The design purpose of pits and their constituent material leads them to have singular importance, both from the standpoint of national security and that of safety. In

particular, when pits are stored by themselves, not incorporated in a nuclear weapon ("stand-alone" pits), special attention is required to avoid any undue risk.

Most plutonium pits in this country were formerly made at the Rocky Flats Plant of the Department of Energy, situated between Boulder and Golden, Colorado. When manufacture of new pits was ended in 1989, a number of previously made but still unused pits existed outside of completed weapons, along with some others that had been manufactured but that required rework. Also, when weapons are dismantled, their pits are stored as stand-alone pits. In the following, the term "pits" will be reserved to those components not incorporated in nuclear weapons.

The number of stand-alone pits continues to grow as more nuclear weapons are dismantled in accordance with international agreements and national policy, and it is now in excess of 10,000. Most of the nation's pits are stored at this time at the Pantex Plant of the Department of Energy, near Amarillo, Texas, under conditions considered to be secure and also safe for the time being.

Current plans envisage three principal destinies for pits stored at Pantex. Some pits are to be retained in a strategic reserve, in case a decision should be made to use them in nuclear weapons at a future time. Other pits regarded as surplus to any conceivable future defense mission are to be converted from metallic form to a plutonium oxide, which is to be added to depleted uranium oxide. The combination is to serve as the fissionable material in mixed oxide fuel in certain commercial nuclear reactor plants. Plutonium from some surplus pits that will be difficult to use in this way will be disposed of. Numerous decisions must still be made to convert such tentative plans to reality. The most basic ones would establish where certain actions and processes are to take place. They are:

1. Where is the strategic stockpile of pits to be stored?
2. Where is the conversion of metallic plutonium to plutonium oxide to take place?
3. Where is the manufacture of mixed oxide fuel to occur?
4. Where will surplus pits awaiting disposition be stored?

Current actions of DOE are consistent with storage of pits for the strategic stockpile at the Pantex Plant. Pits destined for conversion to plutonium oxide and subsequent incorporation in mixed oxide fuel must be processed into feedstock prior to fuel manufacture. DOE has announced in its Record of

Decision following an Environmental Impact Statement that Savannah River is the preferred site for this conversion to feedstock. For this to take place, pits in the latter category must be shipped to the Savannah River Site from their present location at the Pantex Plant at Amarillo, Texas.

Almost as basic are decisions still awaited regarding the structures in which both medium-term and long-term storage will take place, and the nature of the storage itself including the containers that will be used for shipping and storage. For most of the pits now in storage at Pantex, the outer metallic cladding is the only reliable containment. Although the cladding of pits has rarely failed or been breached, most pits have been protected throughout their existence by the sealed atmosphere within a nuclear weapon, limiting their exposure to incompatible or corrosion-producing materials. However, most pits at Pantex are now in AL-R8 containers with a normal atmosphere, along with celotex packing material that is a potential source of moisture and chlorides. The containers are not tightly sealed, and they are kept in magazines with an atmosphere that communicates with the outside air through a normal ventilation system. The AL-R8 container is used for storage, but not for shipping pits. It is regarded as noncertifiable for shipping. Furthermore, inspection, cleaning, and other operations associated with dismantlement of nuclear weapons makes use of chemicals that could conceivably initiate corrosion or otherwise damage a pit in the long term. The condition of pits following dismantlement is not well documented, and some long-term modes of possible degradation are not well understood. Some types of pits must be kept cool.

In 1992, as the forthcoming size of the inventory of pits came to be realized, DOE began to plan for measures to better protect them. A surveillance program was instituted. A plan was developed to place pits in sealed stainless steel containers called AT-400A, each having a sealed stainless steel insert holding a pit in an inert atmosphere. The AT-400A would have fully protected its enclosed pit, and would have been certifiable as a shipping container. As plans developed, repackaging of pits was to start in 1995 and was to have been completed in five years. However, this repackaging never became a reality. The Pantex contractor found the final weld seal on the AT-400A's insert to be very difficult, and the cost of the AT-400A was concluded to be too high. Use of the AL-R8 continued.

The design laboratories have stated in letters to DOE and to Pantex in 1995 and 1997 that pits, when in AL-R8 containers for an extended period, face a possibility of corrosion. They recommended that no pits should be stored an appreciable period of time in these containers. Further, they stated that if pits are to be stored in AL-R8s for more than five years, aggressive surveillance should be applied and humidity control should be used.

DOE has since pursued a course intermediate between continued use of the AL-R8 alone and introduction of a totally new container such as the AT-400A, and has developed a design of a stainless steel pit container with a bolted, flanged closure, to be an insert for the AL-R8. Some materials compatibility problems have been attached to the design, but these seem surmountable.

The Board has been actively following the development of plans for pit storage, and has discussed the issues with DOE and the Pantex contractor on numerous occasions during the years since 1992. On December 31, 1997, the Board sent to the Assistant Secretary for Defense Programs a comprehensive review of the matter, defining a number of steps believed to be necessary for conduct of an adequate program, and stating that it may be prudent to assign overall responsibility for the endeavor to a senior line manager within DOE to ensure success. No formal reply to the letter was made, although the issue was pursued during briefings of the Board, including some at Pantex. The next written communication on the matter occurred in a letter from the Deputy Assistant Secretary for Military Application and Stockpile Management, DOE, on October 14, 1998. The letter informed the Board that proposed use of the AT-400A container had been abandoned in favor of the AL-R8 with a sealed insert.

On November 6, 1998, a letter from the same source transmitted a copy of an Integrated Pit Storage Program Plan (IPSP) which included up-to-date plans for interim storage of all Pantex pits (an earlier version of the IPSP had been furnished the Board in January 1998, but that had been withdrawn). The Board responded on March 12, 1999, finding that the IPSP did not adequately address the concerns stated in its letter of December 31, 1997. The IPSP continued to be focused on short-term goals and did not take into account the need for informed decisions to be made regarding critical elements of the pit management system, such as the selection of pit packaging and storage

facilities and preparation for eventual shipment to disposition facilities.

On April 15, 1999, the Assistant Secretary for Defense Programs responded in a letter agreeing that the IPSP does not fully address all pit life-cycle issues. He stated that the Plan was intended to ensure safe storage in the near-term. He also promised to form a multi-disciplinary team in the summer of 1999 to identify appropriate issues and develop the desired end-states, to assign, subject to higher approval, the responsibilities for their achievement, and to identify the resources. The IPSP would be modified accordingly.

The rate of repackaging of Pantex pits is not well predictable, but one estimate places corresponding completion of the task at no sooner than the year 2008. The Pantex contractor is seeking a means to operate two shifts within present budgets, which could mean a completion date approximately in the year 2006. Startup of a second repackaging line might speed the process by about two years. Since the original plan was to repackage all pits in AT-400A containers by the year 2000, even the most intensive of these possibilities would amount to a long delay during which pits would reside in present AL-R8 containers in conditions regarded by the design laboratories as undesirable.

There are some safety questions regarding the present design of the AL-R8 system with the sealed insert. The celotex in the outer container may constitute a chemical threat to the sealed insert because of questions of moisture and chlorides. The principal question relates to the carbon steel bolts used for the flanged closure of the sealed insert because these bolts may be more subject to corrosion, and their failure would expose the pit within to the conditions which had caused bolts to fail. The Board considers these design questions to be readily solvable. Finally, the end product of the repackaging into the AL-R8 would be placement of all pits in containers unsuitable for shipping, and pits slated for conversion to mixed oxide for reactor fuel might not be available for repackaging in containers that could be certified for shipping until well into the 21st century. To conduct the necessary repackaging into shipping containers not yet even designed would subject personnel to additional radiation exposure. There are no present plans to avoid this situation.

Apart from possible effects of readily avoidable design problems of sealed inserts for AL-R8 containers, the Board regards the use of these sealed inserts for repackaging of pits stored at Pantex

to be the basis for acceptable solution during the near term. Repackaging pits

into the improved AL-R8 should adequately solve the problems that the design laboratories identified as attached to the existing system of storage. Inspection over time will tell how long such storage can be relied on.

On the other hand, the length of time foreseen for arriving at repackaging of pits into this acceptable state is not compatible with avoidance of safety problems identified by the design laboratories. The Board is also concerned regarding these potential problems. They are a legacy of past manufacture of nuclear weapons and are among the questions raised by the Board's Recommendation 94-1, which addressed the need for safe interim storage of these legacy materials.

Pits in the strategic reserve at Pantex have great value to national defense. These pits, manufactured at great cost and great effort by the Department of Energy and its forebears, are probably only second in importance to nuclear weapons in the military stockpile. In the nuclear weapons defense system, they are effectively irreplaceable. Their assured safe protection should be a vital component of national defense.

Furthermore, DOE's program plan for materials disposition is in peril regarding recycling excess pits into mixed oxide fuel, because there is no container suitable for shipping the pits from the Pantex Plant to the Savannah River Site, and no plans exist for development of such a container. To further the safety of pits at the Pantex Plant, the Board recommends that:

1. The remaining questions of materials compatibility affecting the possibility of chemical attack on closure of sealed inserts for AL-R8 containers be settled expeditiously;
2. Action be taken to accelerate the repackaging of pits into containers suited to safe storage for the near term;
3. A system of statistical sampling for continued integrity of containers and their sealed inserts for repackaged pits be put into effect suited to forecasting the horizon for need for further repackaging; and
4. The importance of the above measures be emphasized by defining them as the specific responsibility of a designated individual of the stature, position, and technical knowledge necessary for their accomplishment, and

who is given the authority and resources required.

John T. Conway,
Chairman.

**APPENDIX—Transmittal Letter to the
Secretary of Energy**

**DEFENSE NUCLEAR FACILITIES SAFETY
BOARD**

*625 Indiana Avenue, NW, Suite 700,
Washington, D.C. 20004-2901, (202) 694-
7000*

August 11, 1999.

The Honorable Bill Richardson,
Secretary of Energy 1000 Independence
Avenue, SW, Washington, DC 20585-
1000.

Dear Secretary Richardson: On August 11, 1999, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. 2286a(5), unanimously approved Recommendation 99-1, which is enclosed for your consideration. Recommendation 99-1 deals with the safe storage of fissionable material called "pits."

41 U.S.C. 2286d(a) requires that after your receipt of this recommendation, the Board promptly make it available to the public in DOE's regional public reading rooms. The Board believes the recommendation contains no information that is classified or otherwise restricted. To the extent this recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, 42 U.S.C. 2161-68, as amended, please arrange to have it promptly placed on file in your regional public reading rooms.

The Board will also publish this recommendation in the **Federal Register**.

Sincerely,

John T. Conway,
Chairman
Enclosure

c: Mr. Mark B. Whitaker, Jr.

[FR Doc. 99-22278 Filed 8-26-99; 8:45 am]
BILLING CODE 3670-01-P

Appendix B. LIST OF ABBREVIATIONS AND ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Project
APSF	Actinide Packaging and Storage Facility
APT	Accelerator for Production of Tritium
B332	Building 332
BHI	Bechtel Hanford Incorporated
BIO	Basis for Interim Operation
Board	Defense Nuclear Facilities Safety Board
CHE	conventional high explosive
D&I	disassembly and inspection
DAF	Device Assembly Facility
DEAR	Department of Energy Acquisition Regulations
DND	damaged nuclear device
DoD	Department of Defense
DOE	Department of Energy
DOE-AL	DOE Albuquerque Operations Office
DOE-NV	DOE Nevada Operations Office
DOE-OR	DOE Oak Ridge Operations Office
DOE-SR	DOE Savannah River Operations Office
EIS	Environmental Impact Statement
ES&H	DOE Office of Environment, Safety and Health
EUO	Enriched Uranium Operations
FRAM	Functions, Responsibilities, and Authorities Manual
FY	fiscal year
GPRA	Government Performance and Results Act
HAR	Hazard Analysis Report
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HF	hydrogen fluoride
I&C	instrumentation and control
IEEE	Institute of Electrical and Electronics Engineers
IHE	insensitive high explosive
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology Engineering Center
IPMP	Integrated Pit Management Plan
ISM	Integrated Safety Management
ITP	In-Tank Precipitation
KAMS	K-Area Material Storage
LAO	DOE Los Alamos Area Office
LANL	Los Alamos National Laboratory
LEP	life extension program
LEU	low-enriched uranium
LLNL	Lawrence Livermore National Laboratory

LIST OF ABBREVIATIONS AND ACRONYMS (Concluded)

LMES	Lockheed Martin Energy Systems
M&O	management and operating
MD	DOE Office of Fissile Materials Disposition
MEMP	Miamisburg Environmental Management Project
MHC	Mason & Hanger Corporation
NESS	Nuclear Explosive Safety Study
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
PDCF	Pit Disassembly and Conversion Facility
PFP	Plutonium Finishing Plant
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environment Technology Site
SARs	Safety Analysis Reports
SFI	significant finding investigation
SI	Sealed Insert
SNFP	Spent Nuclear Fuel Project
SNL	Sandia National Laboratories
SNM	special nuclear material
SQA	software quality assurance
SRS	Savannah River Site
SS-21	Seamless Safety for the 21st Century
TA	Technical Area
TCON	Tritium Facilities Modernization and Consolidation
TRU	transuranic waste
TRUSAF	Transuranic Storage and Assay Facility
TSRs	Technical Safety Requirements
TVA	Tennessee Valley Authority
TWRS	Tank Waste Remediation System
U-233	uranium-233
UF ₆	uranium hexafluoride
WIPP	Waste Isolation Pilot Plant
WSRC	Westinghouse Savannah River Company
Y2K	Year 2000