
**SEVENTH ANNUAL REPORT
TO CONGRESS**

**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**



FEBRUARY 1997

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February 25, 1997

To the Congress of the United States:

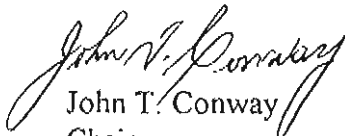
The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to the Congress its annual report for calendar year 1996. The Board is an independent executive branch establishment responsible for providing advice and recommendations to the Secretary of Energy regarding public health and safety issues at Department of Energy (DOE) defense nuclear facilities, and to the President if necessary. The Board also reviews and evaluates the content and implementation of health and safety standards, as well as other requirements, relating to the design, construction, operation, and decommissioning of DOE defense nuclear facilities.

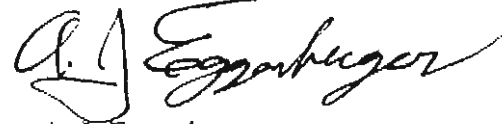
As required by statute, the Board's report summarizes activities during calendar year 1996, assesses improvements in the safety of DOE defense nuclear facilities, and identifies remaining safety problems.

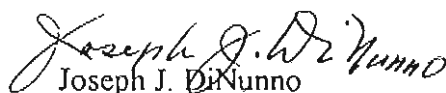
During 1996, with the cooperation of DOE, the Board devoted significant attention to ensuring the safe stabilization of residues and wastes, set the framework for integrated safety management programs across the defense nuclear complex, and stimulated DOE progress toward upgrading the technical expertise of its staff.

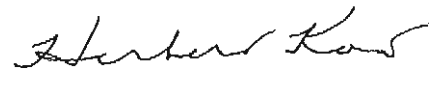
Of particular concern was the loss of nuclear weapon expertise due to downsizing the weapons national laboratories. In response to earlier Board recommendations, more than 100 individual and group interviews of retired weapons experts were conducted to record their safety and reliability knowledge that otherwise was in danger of becoming irretrievable. Efforts were also directed toward upgrading safety analytical reviews preparatory to specific weapon disassembly. It is essential that safety and reliability continue to be given top priority in implementing our nation's stockpile stewardship and management efforts.

Respectfully submitted,


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A. J. Eggenberger
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Joseph J. DiNunno
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EXECUTIVE SUMMARY

During the past seven years, the Defense Nuclear Facilities Safety Board (Board) has witnessed profound changes in the mission of the Department of Energy (DOE). In early 1990, DOE faced numerous issues concerning the safety of its operations at several facilities in the defense nuclear complex. A number of facilities had been shut down for extended periods (e.g., the K- and L-Reactors at the Savannah River Site and certain production facilities at the Rocky Flats Environmental Technology Site); they would remain shut down. In addition, with the end of the Cold War, the mission of the complex shifted from the production of plutonium and tritium and the fabrication, assembly, and testing of nuclear weapons to the stewardship of the remaining weapons stockpile, the dismantlement of nuclear weapons removed from service, and the cessation of nuclear weapons testing. DOE was also faced with the daunting task of bringing numerous facilities to a safe shutdown condition and cleaning up the radioactive contamination that had accumulated during approximately fifty years of weapons production.

The Board has retained its flexibility during this continuing transitional period, adapting to DOE's evolving mission. During 1996, the Board devoted significant attention to ensuring the safe stabilization of residues and waste, set the framework for integrated safety management programs across the defense nuclear complex, and stimulated DOE progress toward upgrading the technical expertise of its staff. These accomplishments could not have been realized without the substantial cooperation of Secretary O'Leary and those with line management responsibility, notably Deputy Secretary Charles Curtis and Under Secretary Thomas Grumbly.

Significant progress has been made in improving the safety of operations in the defense nuclear complex. This has been accomplished by both DOE and the Board working together, with mutual respect for our separate roles and responsibilities.

A summary of accomplishments in 1996 follows. Many of these achievements relate to matters pursued by the Board during a period of years. Most represent milestones in continuing programs for protecting the health and safety of workers, the public, and the environment.

- Plutonium and transplutonium solutions are chemically unstable and are readily dispersible. In pursuing its safety mission, the Board has paid close and continuing attention to facility preparations and stabilization activities associated with these solutions. The Board's efforts have contributed to:
 - Dissolution of approximately 138 metric tons of deteriorated Mark-31 plutonium targets in F-Canyon at the Savannah River Site for conversion to stable metal in FB-Line.

- Operation of F-Canyon and FB-Line at the Savannah River Site and stabilization of about 50,000 gallons of plutonium solutions.
 - Preparations for restart of the Savannah River Site H-Canyon and HB-Line to support expedited stabilization of plutonium and neptunium solutions.
 - Initiation of the development of a vitrification capability in F-Canyon to stabilize the highly radioactive americium/curium solutions and the H-Canyon neptunium solutions.
 - Initiation of plutonium solution processing in Buildings 771 and 371 at the Rocky Flats Environmental Technology Site and the start of hydroxide precipitation processing.
 - Processing of about 2,700 liters of highly enriched uranium solution containing more than half a metric ton of highly enriched uranium, thereby eliminating all highly enriched uranium solutions stored at the Rocky Flats Environmental Technology Site.
- The Senate Armed Services Committee report on S. 1085, establishing the Board, includes the following mandate: “The Board is expected to raise the technical expertise of the Department substantially. . . .” In 1996, Board actions to address this problem included a public meeting in January and issuance of a technical report¹ in March, which led directly to a joint DOE/Board conference held June 13-14, 1996. As a result, DOE has now initiated the first rigorous review of the technical qualifications of its Senior Technical Safety Managers. Additionally, DOE efforts to address critical unmet staffing needs in the latter half of 1996 resulted in the hiring of 56 new staff members under its excepted service authority.
 - The Board issued Recommendation 96-1 in August 1996, urging DOE not to proceed with large-scale process testing at the In-Tank Precipitation (ITP) Facility at the Savannah River Site until the mechanisms by which flammable gases are generated, retained, and released in the ITP process are better understood. Recent test results have suggested that the precipitated cesium and potassium tetrphenylborate solids, as well as the excess tetrphenylborate in solution, may be vulnerable to rapid decomposition by catalytic attack under certain conditions. Such a case would pose a major flammability hazard from the resulting benzene.

¹ *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH-10.

- As a result of the Board's initiative, sludge and incinerator ash residues at Hanford's Plutonium Finishing Plant have been stabilized.
- In response to Recommendation 94-1, the contractor at the Rocky Flats Environmental Technology Site has inspected, treated, and repackaged more than half of 1,858 plutonium items identified as posing a potential fire hazard. More than 42 kilograms of plutonium oxide has been stabilized.
- Addressing the Board's identification of one of the most unstable forms of plutonium, workers at the Rocky Flats Environmental Technology Site have drained ten tanks of plutonium-bearing solutions left behind from past production processes in Building 771. In addition, more than 900 liters of plutonium and uranium solutions in Building 774 was mixed with cement to form a solid, more stable form of waste.
- In 1996, in response to the Board's urging, DOE and the Hanford contractor submitted a major revision to the implementation plan for Recommendation 93-5. The revised plan was accepted by the Board. This revision better recognizes the data needs for each major safety issue and establishes priorities for sampling of individual waste tanks based on these needs.
- In September 1996, in response to Recommendation 94-3, DOE submitted an integrated program plan for completion of required upgrades to Building 371 at the Rocky Flats Environmental Technology Site, development of a safety management program, and initial actions toward the Department's preferred alternative of constructing an interim storage vault in lieu of using Building 371 for that purpose. The Board accepted the plan. In late 1996, the structural upgrades were designed and installed, thus making the building structurally adequate for a storage mission.
- In January 1996, the Board requested that DOE take action to eliminate potentially explosive amounts of hydrogen in certain tanks containing plutonium solutions at the Rocky Flats Environmental Technology Site. The affected tanks have now been sampled, and the contractor has purged 43 of 76 tanks in Building 771 and 6 of 8 tanks in Building 371.
- At the beginning of 1996, the authorization basis² for the Hanford tank farms consisted of a loosely maintained collection of various safety assessments,

² Authorization basis is broadly defined as "... the composite of information a contractor must provide in response to all environmental, safety, and health requirements applicable to a facility." An authorization basis includes those aspects of facility design and operational requirements relied upon by DOE to authorize operations (*Fundamentals for Understanding Standards-Based Safety Management of Department of Energy Defense Nuclear Facilities*, DNFSB/TECH-5, p.13).

analyses, requirements, and procedures. At the urging of the Board, the Hanford contractor developed a Basis for Interim Operations (BIO) based on a full hazard analysis, thus providing not only the first complete picture of the risks associated with tank farm operations, but also a necessary start on development of an acceptable authorization basis.

- In response to Recommendation 95-1, DOE has taken action to slow the degradation of cylinders containing depleted uranium hexafluoride (UF_6) in outdoor storage at the three gaseous diffusion plants. Substantial progress has been made, including removal of cylinders from direct ground contact, design and construction of new and improved cylinder storage yards, and initiation of a pilot program for recoating entire cylinders (more than 1,500 cylinders have already been recoated under this pilot program).
- The Board identified a number of deficiencies in the execution of the initial Operational Readiness Review for startup of the High-Level Liquid Waste Evaporator at the Idaho Chemical Processing Plant. As a result, improvements in formality of operations and in DOE line management review of the contractor's readiness were observed in a subsequent Operational Readiness Review. Further improvements are required, however, to assure safety.
- In response to Recommendation 94-4, the Oak Ridge Y-12 Plant contractor and DOE took a number of steps to correct deficiencies in criticality control that had been identified. These steps were recognized as necessary to prepare for resumption of operations. Operational activities in three of five mission areas for which corrective actions were required were restarted in 1995, and activities in a fourth were successfully resumed in 1996.
- The Board's interest spurred the development of formal methods for integrated safety management review and authorization of subcritical experiments at the Nevada Test Site. These methods are scheduled to be institutionalized by two new DOE-Nevada Operations Office Orders in early 1997.
- As a result of Recommendation 93-6, three Weapon Safety Specifications were issued, incorporating previously unrecorded operational safety information. More than 100 individual and group archiving interviews of retired weapons experts were conducted by the weapons laboratories and weapons production and testing facility organizations, and records of the dismantlement process that were in danger of becoming irretrievable were preserved.
- In response to Recommendation 93-1, DOE revised nuclear explosive safety directives, including two DOE orders, an implementation guide, a technical standard on the Nuclear Explosive Safety Study (NESS) process, a technical

standard on performing hazard analysis, and an interim rule on the Personnel Assurance Program.

- In February 1996, the Board entered into a Memorandum of Understanding with DOE, the Environmental Protection Agency, and the State of Colorado to ensure the cooperation of oversight and regulatory bodies during decommissioning at the Rocky Flats Environmental Technology Site. A lead oversight or regulatory agency is designated as the sole contact with DOE for each decommissioning activity or material, to the extent provided by law. This should avoid redundant and duplicative regulation and inconsistent safety instruction at the site. As recently acknowledged by Congress, similar arrangements could result in efficient and effective oversight and regulation at other defense nuclear sites throughout the complex.
- The Board has been influential in arranging for reactivation of a long-term study of the original group of twenty-six individuals who received known radiation exposures from internal deposition of plutonium. Affected individuals were examined every five years from 1951 through 1991. The target group includes nineteen surviving workers who were exposed during the time they worked at Los Alamos National Laboratory in the early days of the nuclear arms race.

In achieving this progress, the Board has demonstrated the value of a small, dedicated, technically competent group conducting oversight of safety at DOE facilities. Successes result from the ability of the Board and its staff to interact with DOE and contractor officials at all appropriate levels in a timely fashion. As a result, badly needed changes and safety improvements are acknowledged more readily by the officials involved at all levels, and corrective actions are expedited. This scenario has been acted out many times over, in almost all the areas of safety interest that have commanded the Board's attention.

The Board looks forward to meeting future challenges in helping DOE improve safety management plans at defense nuclear facilities. These challenges will be met, and the safety of workers and the public will be enhanced, by the Board's ongoing programs for monitoring DOE's activities, to ensure the safety and reliability of the weapons in the stockpile; verifying the safe dismantlement of nuclear weapons; overseeing the processing of production residues and handling of contaminated waste; and confirming the safety of deactivation, decommissioning, and restoration of former production facilities.

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1. INTRODUCTION

The Manhattan Project, initiated in the early days of World War II, is generally recognized as the start of the nuclear age. Since then, the Department of Energy (DOE) and its predecessor agencies, the Atomic Energy Commission and the Energy Research and Development Administration, have produced considerable quantities of special nuclear materials and designed, manufactured, tested, and maintained the weapons in the nation's nuclear arsenal. During most of the last fifty years, the nuclear weapons complex operated without independent external oversight. In 1988, Congress, mindful of the accumulating public health and safety issues involving many of the aging defense nuclear facilities, enacted into law the creation of the Defense Nuclear Facilities Safety Board (Board). The five-member Board, composed of "respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board," was empowered to provide advice and recommendations to the Secretary of Energy to ensure adequate protection of public and worker health and safety at DOE's defense nuclear facilities. The Board became functional in late October 1989, when the charter Board members were sworn in.

The Board is responsible for independent oversight of all activities relating to nuclear safety within DOE's nuclear weapons complex. Today, DOE is actively engaged in the ongoing process of disassembling nuclear weapons, maintaining the remaining weapons in the stockpile in a safe and reliable condition, and conducting research focused on ensuring the continued stewardship of the stockpile. In addition, considerable attention is currently being devoted to safe disposition of fissionable material removed from disassembled weapons and of material remaining in the system following the abrupt cessation of many production activities more than seven years ago. Many of DOE's current activities are associated with cleanup of extensive radioactive contamination resulting from decades of production.

Its enabling statute, 42 USC § 2286, *et seq.*, requires the Board to review and analyze facility and system design, operations, practices, and events, and make recommendations to the Secretary of Energy that are necessary to ensure adequate protection of public health and safety. The Board must consider the technical and economic feasibility of implementing the recommended measures, and the Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary considerations. If an imminent or severe threat to public health or safety is determined to exist, the Board is required to transmit its recommendations to the President, as well as to the Secretaries of Energy and Defense.

The Board is required by law to review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements pertaining to the design, construction, operation, and decommissioning of DOE defense

nuclear facilities. The Board must then 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 the public health and safety are adequately protected. The Board is further required to review the design of new defense nuclear facilities before their construction begins, as well as modifications to older facilities, and to recommend necessary changes. The Board's review and advisory responsibilities continue throughout the full life cycle of facilities, including the shutdown and decommissioning phases.

The Board may 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. These ancillary functions relate to the accomplishment of the Board's primary function, which is to assist DOE in identifying and correcting health and safety problems at defense nuclear facilities. The Department and its contractors at defense nuclear facilities are required to cooperate fully with the Board.

The terms of the enabling statute give clear guidance about what Congress expected the Board to do and in what manner. Congress expected the Board's oversight to have many of the same positive results as formal regulation: assurance that DOE is implementing a program that provides for the safe management of the production and use of defense nuclear materials, which, in turn, gives reasonable assurance of no undue risk to workers and the public, and protects the environment. Congress was well aware that DOE had issued safety policies and standards of good practice. However, Congress was also aware that these practices needed upgrading, and that DOE and contractor operations in the past had left extensive residual contamination in buildings and the surrounding environment. DOE's problem appeared to be primarily a failure to establish clear expectations of its contractors and to build safety compliance into the fabric of work planning and execution.

During the past seven years, the Board has focused much of its attention on examining the standards identified by DOE as codes of good practice, the way DOE defines what is expected of its contractors in the performance of the Department's mission, and the means by which such requirements are enforced. These elements are basic to any safety management program, whether internally or externally driven. The most significant deficiencies in these basic elements have been communicated to DOE by means of the recommendation process set forth in the Board's enabling statute. These recommendations not only describe perceived deficiencies, but also provide guidance as to what the Board believes are advisable solutions. Implementation plans for addressing the issues identified in these recommendations are then submitted by the Secretary for Board approval. The Board follows the progress of each required action program until the planned action has been completed. To date, the Board has issued 34 sets of recommendations containing 149 specific recommendations; these are discussed in detail later in this report.

In meeting its responsibilities, the Board recognizes DOE's legitimate need to do its essential national defense work without unjustifiable delay. Through assignment of its staff to monitor and review work involving design, construction, or preparations for readiness to

operate, the Board has been able to keep its safety reviews synchronized with DOE activities. Technical concerns that arise during these reviews are frequently resolved by the technical staffs of DOE, the Board, and contractors without the need for formal action-forcing measures by the Board. If the Board determines there are unresolved safety issues that require resolution before work proceeds, it can define those issues and recommend their resolution by the Department. In the case of operations at the Rocky Flats Environmental Technology Site, Congress required that before resumption of plutonium operations in specified buildings, the Board determine to its satisfaction that DOE's response to specific recommendations of the Board adequately protects public health and safety.

In addition to its reviews of the basic elements and structure of DOE's safety management program, the Board has given priority attention to particular facilities and activities considered to represent the greatest safety risks—mainly those that now comprise the remaining portions of the nuclear weapons complex devoted to (1) the stewardship, maintenance, and surveillance of nuclear weapons; (2) the stabilization of hazardous remnants of weapons production; and (3) the storage of strategic and highly radioactive materials. For those facilities and operations representing significant hazards, the Board is actively pressing DOE to develop improved safety management programs that would result in clearly defined systems and components important to safety, technical specifications defining limiting conditions for operation, and the infrastructure needed to support maintenance and safety in operation. This has already been done for a number of facilities and operations. The extension of this effort to high-risk facilities is the thrust of Recommendation 95-2, *Safety Management*, the end goal of which is to have safety management programs that are not only well defined, but also tailored to the diverse operations of the DOE complex.

With respect to decommissioning of defense nuclear facilities, the Board has thus far paid particular attention to those facilities in transition to cleanup or environmental restoration under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). CERCLA and RCRA statutes are administered by the Environmental Protection Agency (EPA) and the states. The Board is working cooperatively with EPA and the states to effect a smooth transition to CERCLA and RCRA oversight by the states involved, and has recently signed cooperative agreements with the State of Colorado, EPA, and DOE with respect to activities at the Rocky Flats Environmental Technology Site.

The Board is required by statute to report to Congress each year concerning its oversight activities, its recommendations to the Secretary of Energy, and safety improvements achieved at defense nuclear facilities as a result of its activities. This report responds to that requirement. It is organized as follows:

- Section 2 describes the major technical activities of the Board during 1996.
- Section 3 addresses administrative matters.

- Section 4 identifies the Board's performance goals.

In addition, two appendices are provided: Appendix A contains the *Federal Register* notice for Recommendation 96-1, while Appendix B describes the Board's progress toward implementation of the provisions of the Government Planning and Reporting Act of 1993.

2. MAJOR TECHNICAL ACTIVITIES OF THE BOARD DURING 1996

This section reports on major technical activities of the Board during 1996 in the following areas:

- Activities related to stewardship of the weapons stockpile (Section 2.1)
- Cross-cutting activities that apply to several facilities or sites, or to the entire defense nuclear complex (Section 2.2)
- Activities related to decontamination and decommissioning (Section 2.3)
- Activities related to design, construction, and initial operations (Section 2.4)
- Activities related to plutonium stabilization (Section 2.5)
- Activities related to waste management (Section 2.6)

2.1 ACTIVITIES RELATED TO STEWARDSHIP OF THE WEAPONS STOCKPILE

Nuclear weapons remain a vital part of U.S. national security. With the end of the Cold War, the manufacture of nuclear weapons ceased, and with the Administration's commitment to conclude a Comprehensive Test Ban Treaty, all underground testing of nuclear weapons ended as well. DOE's strategy for dealing with this significantly changed mission is embodied in its *Stockpile Stewardship and Management Plan*. Formalized by the Secretary of Energy on December 19, 1996, 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. This new approach also calls for construction of selected facilities with enhanced experimental capabilities; these facilities will be operated at the various national laboratories. Weapons manufacturing capability at existing plants will be maintained, but the plants' capacity will be appropriately reduced. In addition, the capability for manufacturing components of plutonium pits will be reestablished at a national weapons laboratory.

These changes will have a significant impact on the way DOE assures safety in its facilities for research, manufacturing, assembly, disassembly, and testing of nuclear weapons. For example, existing weapon systems will remain in the nation's stockpile significantly longer than in the past. New methods will be necessary to ensure that operations involving nuclear weapons remain safe while the weapons are in the custody of the Department. In addition, in the absence of underground nuclear testing, alternative means of testing and confirming the safety of weapons at all stages in their life cycle are being developed.

The Board will continue to assess the safety implications of these changes and monitor DOE's implementation of the *Stockpile Stewardship and Management Plan*.

2.1.1 Pursuit of an Integrated Approach to Safety in DOE's Nuclear Explosive Operations

Since late 1991, when it was assigned oversight responsibility for the assembly, disassembly, and testing of nuclear weapons, the Board has been assessing the safety management programs for the design, operation, and maintenance of facilities for nuclear explosive operations and comparing such programs with other nuclear programs both within and outside the DOE complex. These reviews have led the Board to conclude that substantially enhanced safety could be achieved by improved integration of explosive safety management programs and other nuclear safety programs.

As a result, the Board issued two recommendations (93-1 and 93-6) and a reporting requirement. The Board determined that two distinct and inconsistent safety management programs existed at nuclear explosive facilities—one for nuclear explosive operations and another for operations involving nuclear materials not combined with explosive materials. Further, the Board noted that the existing safety management system for nuclear explosive operations was largely expert-based, as opposed to the more standards-based approach that was pioneered by the commercial nuclear industry and was in the process of being implemented at DOE's other nuclear facilities. The Board identified two potential problems associated with DOE's expert-based approach:

- Weapons experts were retiring and, for the most part, leaving a void in knowledge and expertise at the weapons design laboratories.
- Nuclear Explosive Safety Studies (NESSs)—safety assessments of explosives in proximity to nuclear materials—lacked documented rigor.

These issues are discussed further in the subsections below.

During the past three years, the Board has interacted frequently with DOE to improve the management of safety in nuclear explosive operations. Fifteen letters have been sent to DOE containing specific observations regarding the nuclear explosive safety study process and its integration with other facility safety processes. Beneficial changes have resulted, as subsequent discussions in this report indicate (see Section 2.1.2).

Access to Weapons Expertise. In Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*, the Board urged DOE to establish formal programs to capture knowledge possessed by nuclear weapons experts who are retiring or otherwise leaving the program. The Board considers such information to be essential to the safe maintenance of the enduring nuclear stockpile, the safety of dismantlement programs at the Pantex and Oak Ridge Y-12 plants, and the retention

of the capability to safely resume nuclear testing should that course of action be directed by the President.

DOE's initial attempts to implement Recommendation 93-6 were not successful, as noted in the Board's sixth annual report. The Board staff worked closely with DOE to develop a revised implementation plan, which was subsequently submitted to the Board in February 1996. The Board has noted significant progress in DOE's execution of this plan during the remainder of 1996. Several examples can be cited. First, the Oak Ridge Y-12 Plant and the DOE Oak Ridge Operations Office institutionalized and implemented an effective knowledge preservation program. Second, the Sandia National Laboratories implemented a knowledge preservation program that showed good promise. Third, the Lawrence Livermore National Laboratory took steps to start and conduct an effective program to capture the knowledge of retirees. Finally, the Los Alamos National Laboratory developed a program that placed considerable emphasis on documenting the expertise of senior weapons design personnel, including retirees, for both Pantex and Nevada Test Site operations.

This progress has been accompanied by some difficulty in ensuring that the weapons laboratories complement their efforts to preserve weapon design information with actions to capture operational safety information. The Board sees the need for improvement in this area at all the weapons laboratories and will continue its oversight of this matter.

Recommendation 93-1. In early 1993, the Board issued Recommendation 93-1, *Standards Utilization in Defense Nuclear Facilities*, recommending that DOE address the differences between the safety requirements applicable to nuclear explosive facilities and those applicable to other defense nuclear facilities. In response, DOE issued an implementation plan aimed at ensuring that the requirements governing the safety of nuclear explosive operations would be fully integrated with those for other defense nuclear operations.

Later in 1993, the Board established a reporting requirement calling on DOE to address specific issues associated with the nuclear explosive safety study process used by the Department to ensure the safety of its nuclear explosive operations. DOE responded with a Nuclear Explosive Safety Study Corrective Action Plan (NESSCAP), which identified several fundamental improvements in the nuclear explosive safety study process. In addition, the plan committed DOE to resolving issues associated with contamination by and dispersal of plutonium and other radioactive material, addressing the evaluation of environmental safety and health requirements during nuclear explosive operations, and improving the planning and conduct of appraisals of nuclear explosive weapon safety. Moreover, with the Board's approval, DOE combined that plan with the implementation plan for Recommendation 93-1, to ensure that the requirements governing the safety of nuclear explosive operations would be fully integrated.

During 1996, DOE completed the revision of its nuclear explosive safety orders. The orders package now includes the two applicable orders, an implementation guide, a technical

standard on the safety study process, a second technical standard on performing hazard analysis, and an interim rule on the Personnel Assurance Program. These new safety requirements meet the objectives of both the NESSCAP and Recommendation 93-1. When fully implemented, they will better ensure that operations at those facilities that assemble, disassemble, and test nuclear weapons will provide the requisite protection of the public, workers, and the environment.

Several issues will continue to require Board attention during implementation of these requirements. For example, the quality of documentation and reports will need to be improved to meet the new guidelines in the standard. The Board and its staff will continue to work with DOE in developing guidance for the conduct of nuclear explosive safety study reviews. The goal of such technical interactions is to ensure that these reviews provide a thorough technical analysis of the potential hazards of the operations, determine the safety impact of procedural and equipment changes, and resolve potential safety issues prior to operation.

DOE has recently formed a task force to integrate facility Safety Analysis Reports with operations Hazard Analysis Reports, and to address deficiencies at the interface between safety and hazard analyses. The Board will continue to follow the development of DOE's standard on hazard analysis for nuclear explosive operations. In addition, the Board will follow closely DOE's activities designed to ensure that the analyses of specific weapons operations complement the safety analyses of the facilities, and that the two together are appropriately comprehensive.

DOE's Assistant Secretary for Defense Programs has recently concluded that the safety practices applied to nuclear explosive operations must be extended to subsidiary operations involving nuclear weapons. The Board supports this decision.

2.1.2 Activities Related to Specific Sites/Facilities/Activities

Safety Management of Research and Development at the Weapons Laboratories. As discussed briefly in Section 2.1, the three weapons laboratories (Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratories) have taken on a greatly increased role under DOE's *Stockpile Stewardship and Management Plan*. The laboratories will be shouldering new responsibilities in the areas of production and surveillance, in addition to expanded research and development.

It is recognized that work planning, which includes the analysis of hazards and the subsequent development and formal implementation of preventive and mitigative controls, needs considerable improvement at some research and development facilities of the weapons laboratories. For example, at Los Alamos National Laboratory, there have been several recent incidents and accidents whose root causes could be traced directly to inadequate understanding of the hazards or lack of implementation of protective measures. Work planning will continue to receive increased emphasis throughout 1997.

The Board's efforts in safety management have kept pace with those of DOE. In 1995, the Board asked the Department to prepare a report addressing the proper manner of ensuring that nuclear research and development at the laboratories is conducted safely and in accordance with safety requirements that do not unduly impede the creative process. This reporting requirement, which served as a precursor to the Board's technical report on *Safety Management and Conduct of Operations*, DNFSB/TECH-6, and Recommendation 95-2 (see Section 2.2.3), noted that the nuclear safety standards made obligatory by DOE for its operating contractors have general applicability to the wide diversity of DOE activities. Although DOE's safety policy and the applicable standards permit a "graded" approach, in which the formality of operations varies in form and degree depending on the nature and extent of the hazards involved, just what is acceptable has never been well defined, nor is its definition apparent from case histories. This is especially true for the weapons laboratories, where there are far more research and development activities under way than production activities, and in which the mix of skills for research and development is much different from that for production.

The weapons laboratories have maintained that safety management programs should reflect this difference. The Board also believes that DOE requirements need not be applied in the same way at both production facilities and research and development laboratories; i.e., it is not a "one size fits all" situation. Believing that the laboratories are in the best position to define a safety management program for facilities where research and development functions are dominant, the Board has encouraged them to do so. The reaction of management at the laboratories has been positive, as evidenced by the progress being made in developing integrated safety management programs in response to Recommendation 95-2 (discussed further below).

In a parallel but separate activity, the Secretary of Energy's Advisory Board was asked to review the Department's management of its laboratories. Among other conclusions, the Advisory Board's review committee, chaired by Robert Galvin, stated that the laboratories were subject to excessive micro-management in the form of a multiplicity of DOE internal and external audits of laboratory operations.

In response to the Galvin report, DOE established an Environment, Safety and Health (ES&H) Oversight Pilot initiative, in which all three weapons laboratories currently participate. This study is intended to determine whether DOE's on-site appraisal activities could be reduced substantially through increased dependence on the results of the laboratories' self-assessment programs. It became evident in 1996 that all of those programs will require significant upgrading before they can provide adequate assurance of effective safety. This conclusion was reached by DOE field personnel as they monitored the progress of the initiative, and was confirmed by reviews conducted by the Board staff at the three weapons laboratories. The required improvements are expected to be incorporated in the laboratories' integrated safety management plans.

Pantex Plant. The Pantex Plant, located outside Amarillo, Texas, is DOE's remaining site for the assembly, disassembly, and surveillance of nuclear weapons. In

addition, it serves as an interim storage site for retired weapons and strategic reserve plutonium. Pantex also plays a central role in DOE's plans for stockpile stewardship and management.

The Board has continued its review of the content and implementation of safety basis documents at Pantex. During the past year, the Board has monitored activities at Pantex to develop new Safety Analysis Reports and Technical Safety Requirements, and to improve the Unreviewed Safety Question Determination (USQD) process used for reviewing and correcting such documents. The Board notes that its previous efforts have resulted in improvements in the analysis and control of safety, and that the newer Safety Analysis Reports and Basis for Interim Operations documentation also represent an improvement.

The Board continues to find problems, however, with the Pantex safety basis documents. For example, the Board staff found that the DOE-approved safety limit for temperature control of environmental chambers used to age nuclear explosives artificially was set at the exact temperature at which a runaway reaction could be expected, and therefore it did not provide an adequate margin of safety. After the Board brought this shortcoming to DOE's attention, the Department initiated a broad-based effort to upgrade and properly integrate safety management at Pantex. DOE developed a short-term plan that included action to suspend approval of activities in the environmental chambers, pending the establishment of a firmer basis for safety controls and better assurance of acceptable implementation of those controls. A longer-term effort will be to evaluate all of the current processes used at Pantex to assess safety and develop safety controls. This evaluation is intended to identify areas of overlap (i.e., where streamlining is possible to accelerate the implementation of safety improvements), gaps (i.e., where a hazard may go unidentified or unmitigated), and control measures that merit augmentation.

On a related matter, the Board is working with DOE to improve the Pantex USQD process. During the past year, the Board identified several conceptual errors in the process used to determine whether proposed changes in activities or questions raised about an existing activity have significant safety implications. These errors led to an understatement of the safety significance of some changes. As a result of constructive interactions with the Board and its staff, DOE and its contractor have changed the way USQs are processed at Pantex. This action led Pantex to declare that changes to operations, such as the use of portable x-ray equipment in nuclear explosive assembly cells, constitute positive USQs. For activities that are declared a positive USQ, Pantex developed adequate controls to prevent or mitigate the risks and to execute the activities safely.

Improved Conduct of Operations and Use of Standards—Safety of operations involving nuclear explosives at Pantex is managed through strict adherence to explicit procedures that have been developed, approved, and followed verbatim by knowledgeable personnel. It has long been a common objective of the Board and DOE that those procedures not only be technically sufficient to ensure safety, but also be written so that users can understand them. This is essential at a time when many older and more experienced workers are retiring. Pantex evaluated all of its critical-use procedures to ensure that they are not too

complicated and are sufficiently easy to read, understand, and follow. Pantex now has assurance that the procedures can be used effectively by the technicians who perform hands-on nuclear explosive operations. Pantex has also developed a schedule for converting old procedures to a new format that is clearer and easier to follow.

Integrated Plan—Three long-term initiatives to improve safety are under way at Pantex. First, as part of the Seamless Safety-21 process, activities involving nuclear explosives are being redesigned to improve safety. Second, in support of the project for upgrading Safety Analysis Reports, operations at Pantex will be reanalyzed to ensure that hazards are adequately controlled. Finally, in parallel with these two safety efforts, DOE is in the process of adopting a new set of orders that rely on consensus standards for nuclear operations.

In the last year, with encouragement from the Board, DOE developed its first integrated plan for implementing each of the above safety improvement programs. This plan represents a cooperative effort among DOE, its Pantex contractor, and the national weapons laboratories. It identifies improvements and efficiencies that will allow DOE to expeditiously convert its improved safety concepts into true safety benefits in Pantex operations.

During the past several years, DOE has significantly improved its program for assessing the safety of operations with nuclear explosives. The improved process, as described in the new DOE Orders 452.1, *Nuclear Explosive and Weapon Safety Program*, and 452.2, *Safety of Nuclear Explosive Operations*, together with their associated implementing guides and standards, will increase the technical rigor of nuclear explosive safety reviews and the quality of technical information on which these reviews will be based. Much of the improvement has been guided by DOE's implementation plan for Recommendation 93-1 and the NESSCAP, which responded to the Board's reporting requirement of December 8, 1993 (see Section 2.1.1).

The scope of the Board's interest in integrated safety of nuclear explosive operations includes potential impacts on operational safety from facility, process, and human hazards, as well as hazards inherent in the materials being worked. Nuclear explosive safety studies have historically been defined by, and restricted to, consideration of only those scenarios that would result in nuclear detonation, the detonation or deflagration of high explosives, or fire in the vicinity of a combination of high explosives and nuclear materials. Since the early development of nuclear weapons, nuclear explosive safety studies have emphasized the need for a heightened degree of assurance against unintended nuclear detonation. However, nuclear explosive safety study groups reviewed only those operations involving the assembly of pits and high explosives, in which an accident could potentially result in a nuclear yield. One of the upgrades to the process defined in the recently revised DOE Order 452.2 is a widening of the scope of the studies to cover all operations where pits and high explosives are collocated, even if they are not being assembled. DOE has been working to improve the conduct of nuclear explosive safety studies by implementing requirements in the new orders.

Part of the success of DOE's integrated plan for Pantex is due to a concept in the new Order 452.2 called revalidation, which was introduced by DOE to provide a limited-scope safety review as a basis for extending the expiration date for a nuclear explosive safety study. Revalidations are performed to ensure that the operation studied by the original nuclear explosive safety study has not been altered as a result of subsequently approved changes. Board review of the first several revalidations identified concerns with the process as it was being implemented. Further guidance was then issued by DOE, and the revalidation requirements in the DOE Standard on the Nuclear Explosive Safety Study Process were strengthened. Revalidations bridge the gap between DOE's old and new processes for safety review during the transition to Seamless Safety-21. The Board will continue to watch for improvements in the conduct of revalidations.

Nevada Test Site. Although all underground weapons testing at the Nevada Test Site has been suspended, the Board is continuing its oversight of the safety of subcritical experiments and the planned operations of the Device Assembly Facility.

Safety Oversight of Subcritical Experiments—As part of DOE's Stockpile Stewardship and Management Program, the weapons design laboratories had planned to conduct two subcritical experiments in 1996 at the Nevada Test Site. These experiments were to involve devices containing both high explosives and special nuclear materials in configurations that, by design, could not achieve criticality. The first of these "subcritical" experiments was scheduled to be conducted by Los Alamos National Laboratory in June 1996; the second was scheduled to be carried out by Lawrence Livermore National Laboratory approximately one month later.

The Board staff conducted several reviews at the Nevada Test Site and at Los Alamos National Laboratory to evaluate (1) the hazard analyses prepared by the laboratory for its experiment, (2) DOE's review and authorization process, and (3) the safety management system for the subcritical experiment program. The results of these reviews indicated that, given the low level of hazards, the laboratory's hazard analyses and the resulting plan for a safety management approach were adequate. However, it was not apparent that DOE had a well-defined plan for, or expectations for development of, the necessary authorization basis, technical review, or integrated safety management of subcritical experiments in general. Consequently, in a June 1996 letter, the Board urged the Department and the national weapons laboratories to develop a comprehensive safety management plan addressing the full range of potential hazards associated with future subcritical experiments, and noted that the plan should be graded according to the risk associated with the activity.

DOE subsequently deferred the initial subcritical experiments until 1997, and they have not yet taken place. However, during 1996, the Board and its staff continued to discuss the development of an integrated safety management system for these experiments. In response to the Board's encouragement and guidance, the DOE Nevada Operations Office and the laboratories have developed a promising approach. This approach is to be documented in new Nevada Operations Office orders, which are expected to be finalized in early 1997 and used for future subcritical experiments.

The Board will continue to review the safety bases for the individual subcritical experiments, as well as DOE's review and authorization for these experiments. Review of the hazard analysis for the experiment to be conducted by Lawrence Livermore National Laboratory is scheduled for early 1997.

Device Assembly Facility—The Device Assembly Facility at the Nevada Test Site is a new facility for nuclear explosive operations. Although originally intended for the assembly of one-of-a-kind nuclear test devices, the facility is being modified to accommodate a broader range of operations, such as disassembly, modification, staging, maintenance, repair, retrofit, and surveillance of nuclear weapons.

During 1996, the Board evaluated the adequacy of the facility's safety systems, its safety authorization basis (including facility plans and procedures), and the Device Assembly Facility Nuclear Explosive Safety Master Study. In addition, the Board staff identified and called to DOE's attention deficiencies in the electrical distribution and fire protection systems. The Department addressed these deficiencies in coordination studies for protection devices, anticipated electrical system upgrades, and a consolidated fire hazard analysis.

DOE expects that the facility will commence operations during 1997. Activities will include the assembly of subcritical experiments, the preparations for test readiness exercises, and possibly the conduct of research on surveillance of weapons.

Oak Ridge Y-12 Plant. Activities conducted at the Oak Ridge Y-12 Plant include the manufacture, surveillance, and dismantlement of nuclear weapon components fabricated from both highly enriched and depleted uranium. Since DOE's *Stockpile Stewardship and Management Plan* calls for retaining this capability at the Y-12 Plant, the Board has focused significant attention on reviewing safety-related matters at the site. Several examples of recent Board activities regarding nuclear safety at Y-12 are discussed below.

Conduct of Operations and Criticality Safety—Recommendation 94-4, *Deficiencies in Criticality Safety at the Oak Ridge Y-12 Plant*, discussed weaknesses in criticality safety programs, as well as the adequacy of experience, training, and performance of personnel both at DOE and in contractor operations. In accordance with its implementation plan for this recommendation, DOE and its Y-12 contractor undertook a number of initiatives considered vital to resumption of operations. For example, immediate steps were taken to correct safety deficiencies, and those steps were validated through a formal restart process conducted in accordance with applicable DOE orders. Corrective actions were initiated in 1995 and are scheduled to be completed in 1998.

During the past three years, the Board and its staff have had numerous interactions with DOE regarding restart activities. In addition, DOE has performed several independent functional area assessments (i.e., training, conduct of operations, and criticality safety) in accordance with commitments in the implementation plan. Each assessment found that, in general, DOE has made significant progress toward meeting its commitments in 1996. The evaluators also noted that continued improvement is still called for in those areas which have

been restarted, and that significant work is still needed in those mission areas where restart has not yet occurred, particularly with respect to nuclear criticality safety. The Board will continue to interact closely with DOE as enriched uranium operations (discussed further below) are restarted to support national security programs.

Processing of Excess In-process Highly Enriched Uranium—In late 1995, the Board issued one of its ongoing series of technical reports, *Status of Highly Enriched Uranium Processing Capability at Building 9212, Oak Ridge Y-12 Plant* (DNFSB/TECH-9). In that report, the Board staff observed that in-process, highly enriched uranium materials comprise the largest portion of materials at risk in Building 9212, and that these materials contribute significantly to the radiation doses received by personnel at Y-12. DOE has declared a large amount of this material to be excess to mission needs. The sheer bulk of this material poses problems for managing the inventory and for controlling the radiation exposure of workers. The Board concluded that it would be prudent for DOE to process the material at the earliest opportunity, once Y-12 management has upgraded the authorization basis for Building 9212 and demonstrated its readiness to operate.

In a February 1996 letter forwarding its technical report to DOE, the Board asked DOE to describe actions that would be taken to characterize and catalogue the excess highly enriched uranium residues, and to establish priorities for processing these residues when enriched uranium operations are restarted at the Y-12 Plant. During 1997, and continuing into 1998, the Board will monitor progress toward the successful processing of this material.

Tritium Production Issues. Tritium is a radioactive isotope of hydrogen used in the nation's nuclear weapons. It has a relatively short half-life (12.3 years) and must be replaced periodically in order for the weapons to function as designed. Tritium was last produced in the Savannah River Site K-Reactor, which was shut down in 1988. Currently, DOE does not have the capability to produce tritium.

During the fiscal year 1993 budget process, Congress required the Administration to prepare and submit a report on the tritium stockpile and the necessary schedule for resuming production. In October 1995, the Secretary announced the results of a Programmatic Environmental Impact Statement for Tritium Supply and Recycle. The preferred alternative was a dual-track strategy under which the Department would begin work on two promising tritium production options: use of an existing commercial light water reactor, and construction of a linear accelerator. Current plans require the new tritium facilities to be operational between 2005 and 2010, depending on the required number of weapons in the stockpile.

The Savannah River Site has been selected as the preferred location for an accelerator, should one be constructed. Under this alternative, tritium is produced by exposing targets to an accelerator proton beam, following which the target assemblies are processed to extract the tritium. Under either alternative, new processing facilities to extract the tritium from reactor- or accelerator-irradiated targets are planned for construction at the Savannah River Site.

Starting in fiscal year 1997, the Board intends to review the preliminary designs for these proposed facilities. The Board expects to continue its reviews of these projects as they progress through the detailed design phase into construction, startup, and operation.

Mound Laboratory. The Mound Laboratory (Mound) is currently involved in the cleanup of nuclear waste and in the safe shutdown and decommissioning of facilities formerly used for the production, repackaging, and off-site shipment of nuclear materials. The Board has monitored the radiological safety aspects of DOE's project for unloading more than 500 special tritium reservoir units at Mound. During the past year, only about half of the reservoirs scheduled to be unloaded have actually been unloaded. The main contributor to the slip in schedule was a three-month work suspension to resolve a tritium inventory discrepancy that was eventually attributed to accounting and calibration errors. The Board will continue to review the remaining tritium operations at Mound to ensure that safety issues arising during the final stages of shutdown are properly resolved; the Board has some concern that the level of technical expertise available to complete the remaining tritium operations may be inadequate to deal with technical issues that may arise.

2.2 CROSS-CUTTING ACTIVITIES

A number of issues are common to several facilities or sites, or in many cases to the entire defense nuclear complex. These cross-cutting issues are examined in the following subsections. They include DOE's overall actions to develop and implement sound nuclear safety standards; the emerging program for processing and storing surplus special nuclear materials; the establishment of sound integrated safety management systems; the technical expertise of DOE staff members in both Headquarters and field organizations; the clear and unequivocal articulation of the authorities and responsibilities of DOE staff members; the implementation of adequate reviews of readiness for initiation or resumption of operations; the improvement of the Department-wide program for operational radiological safety; and the health effects of plutonium uptake by workers.

2.2.1 Development and Implementation of Sound Nuclear Safety Standards

In its enabling statute, 42 U.S.C. § 2286 *et seq.*, the Board is assigned responsibility for review and evaluation of “. . . the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility.” In addition to requirements imposed by statute, DOE sets requirements for its contractors through one or both of the following vehicles:

- Rules promulgated in the Code of Federal Regulations
- Contractual requirements drawn from any appropriate source, including, but not limited to, DOE safety orders or Standards/Requirements Identification

Documents (S/RIDs)³ for specific subject areas, and standards established by the American National Standards Institute (ANSI), by other recognized standards-writing bodies (such as technical or professional organizations), or by DOE.

During 1995 and 1996, DOE embarked upon a major undertaking—the Order/Requirement Reduction and Streamlining effort—to revise, improve, and upgrade many of its requirements. The scope of this ongoing effort includes substantial revisions to requirements covering administrative, procurement, and technical aspects of the way DOE conducts its business. These requirements are set forth in a small number of rules and in hundreds of DOE orders covering the broad spectrum of the Department’s responsibilities. The undertaking involves large commitments of the Department’s technical, administrative, and legal staffs.

Of the many hundreds of orders in effect when the revision process was initiated, 51 were related to nuclear safety matters for which the Board has oversight responsibilities. The Board has carefully evaluated the revision effort to the extent that it has addressed these 51 orders. The Board staff conducted an extensive review of each of the original set of 51 safety orders and each of the new safety orders and rules proposed to replace them. Based on that review, the Board staff determined that a majority of the requirements and guidance in most of the safety-related orders should be retained.

In July and September of 1995, the Board held public meetings to review DOE’s development process for “new” safety orders and rules. During these meetings, the Board staff testified that the requirements in some of the proposed rules or draft orders did not represent an adequate set of requirements and guidance for establishing DOE’s safety management program. Based in part on that testimony, the Board concluded that DOE needed to examine more closely the total set of requirements and guidance encompassing nuclear safety. During the September meeting, DOE representatives committed to completing a “crosswalk” for each of the requirements in the previously existing set of 51 safety-related orders, mapping each old requirement to a specific element in the proposed new set.

The Board also held two public meetings on this subject during 1996. The first was on November 7, the second on December 12. At the November meeting, the Board staff reported that DOE had completed its crosswalk. In addition, the staff presented its review and evaluation of the new orders and proposed rules. Of the set of new safety orders in place at the end of 1996, only six were complete and judged by the Board staff to be adequate: DOE 430.1, *Life Cycle Asset Management*; DOE 425.1, *Startup/Restart*; DOE 151.1, *Emergency Management System*; DOE 225.1, *Accident Investigations*; DOE 231.1, *Safety*

³ DOE safety orders or S/RIDs, by themselves, do not impose enforceable requirements on DOE contractors, but become enforceable when they are invoked by specific contract provisions, which are legally binding (see the Board’s technical report *Fundamentals for Understanding Standards-Based Safety Management of Department of Energy Defense Nuclear Facilities*, DNFSB/TECH-5).

and Health Reporting Requirements; and DOE 451.1, *National Environmental Policy Act Compliance Program*. The remaining orders require additional changes.

On the basis of its review of proposed nuclear safety rules, the Board staff concluded that the technical aspects of the rules appeared to be sound, and that the proposed rules retained the essential elements of the predecessor orders. However, policy and legal questions remained regarding the provisions for granting exemptions from regulatory requirements and for rule implementation. These questions were communicated to DOE.

At the December public meeting, DOE managers concurred in the analysis of the orders completed by the Board staff and proposed an action plan for making needed changes to the new safety orders. With respect to proposed rules, DOE staff members agreed with the Board staff regarding exemption language. With respect to other issues raised regarding the nuclear safety rules, however, DOE representatives stated that certain internal Department matters required resolution before further discussion could take place. Both DOE management and the Board expressed a desire to resolve the outstanding issues quickly. Even if full agreement on the content of the new orders and proposed rules can be reached expeditiously, some implementation issues will remain.

2.2.2 Processing and Storage of Surplus Special Nuclear Materials

In Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, the Board recommended that all plutonium metal and oxide be stored in conformance with the then-existing draft of a standard for long-term storage. The Board also urged DOE to expedite preparations to repackage plutonium metal in contact with or in proximity to plastic because of the risk that the hydrogen generated by radiolytic decomposition of the plastic could give rise to an explosion.

DOE initially intended to issue the storage criteria as “guidance” with loose specifications, allowing individual sites to develop specific local requirements. The Board ultimately convinced DOE of the need for a technical standard for the safe long-term storage of plutonium that would provide specific requirements whose fulfillment could be measured—a standard that could be applied throughout the defense nuclear complex. That standard was subsequently issued in December 1994 as DOE-STD-3013-94. As a result of the Board’s participation in the review and revision of this standard, important changes were incorporated, thereby establishing acceptable criteria for safely storing plutonium.

DOE is now using this standard as the basis for the following:

- Storage of plutonium at all DOE sites
- Procurement of a standardized stabilization and packaging process line

- Development of standardized containers to be used throughout the complex
- Consolidated storage of strategic reserve plutonium

DOE reports that all plutonium known to be in direct contact with plastic (the higher-hazard condition) has now been repackaged and that work is progressing to repackage plutonium in proximity to plastic. The Mound Laboratory has shipped its plutonium to the Hanford Site and Los Alamos National Laboratory for repackaging.

2.2.3 Establishment of Sound Integrated Safety Management Systems

In Recommendation 95-2, issued in late 1995, the Board urged DOE to institutionalize a process of integrated safety management for activities at defense nuclear sites. It is the Board's view that effective implementation of Recommendation 95-2 has the potential to upgrade DOE's program for ensuring nuclear safety throughout the defense nuclear complex. To support the achievement of this most important goal, individual Board members expended considerable time and energy throughout 1996 in communicating with DOE Headquarters, field, and contractor elements about the intent of this recommendation.

In Recommendation 95-2, the Board advocated the issuance of complex-wide standards to govern the development, approval, and implementation of integrated safety management. The integrated use of safety management functions and processes to facilitate the conduct of work in achieving site missions is a major objective of this recommendation.

The Secretary of Energy accepted Recommendation 95-2 in January 1996 and submitted an implementation plan in April 1996. In responding to the recommendation, DOE stated that "the Department and Contractors must systematically integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment."

In accepting DOE's implementation plan, the Board stressed the following:

- That the Board was encouraged by DOE's commitment to reconciling and integrating into a consistent whole the existing directives and various DOE initiatives that affect safety management, and to making safety management planning an integral part of work planning.
- That the safety management program developed in response to Recommendation 95-2 should be pursued in parallel with effective implementation of Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*, if the numbers of qualified personnel needed to execute the safety management program are to be available at the right places and at the right times.

- That firm dates for delivery of safety management plans within a year are needed for priority facilities, including the Hanford K-Basins and tank farms, the Lawrence Livermore National Laboratory Superblock, the Los Alamos National Laboratory Technical Area-55 and Chemistry and Metallurgy Research Building, the Pantex Plant cells and bays, the Savannah River Site canyons, the Rocky Flats Environmental Technology Site Buildings 371 and 771, and the Oak Ridge Y-12 Plant.

DOE has made progress in meeting the commitments of its implementation plan. A Safety Management Implementation Team was established early in the process to oversee the execution of the commitments and internal management actions outlined in the plan. A DOE policy to institutionalize the Department's safety management system—DOE P 450.4, *Safety Management System Policy*—was issued in final form in mid-October 1996. An acceptable contract clause was developed that will require contractors to follow the objectives, guiding principles, and functions for safety management. Encouraging as this progress has been, much work will be needed throughout 1997 and beyond to implement fully the intent of this overarching Board recommendation.

The Board was briefed in June and July 1996 on the approaches being taken by the various contractors who are implementing integrated safety management systems at the priority facilities. These briefings indicated that while some projects were progressing more rapidly than others, an encouraging start was evident overall. To assist DOE in developing guidance for Recommendation 95-2 implementation efforts, the Board commented, in an early October 1996 letter, on what it had observed in the contractors' briefings that appeared to reflect particularly effective and useful practices.

Since not all of the ten priority facility briefings to the Board contained firm schedules for implementation of integrated safety management systems, DOE provided a separate set of milestones in early October. Board review of these milestones revealed several issues, which include the following:

- The terms used to communicate the integrated safety management concepts are not clearly defined and consistently employed.
- Front-line operations personnel and operations-oriented personnel do not appear to be involved in concept development and implementation of integrated safety management systems at a site. Without their involvement, it is unlikely that the concepts developed will result in a workable approach.

Resolution of these issues will require both DOE and Board effort in 1997.

2.2.4 Technical Expertise of DOE Staff

The report of the Senate Armed Services Committee on S. 1085 that accompanied the legislation establishing the Board includes the following statement: "The Board is expected

to raise the technical expertise of the Department substantially. . . .” The technical qualifications of DOE personnel who are assigned safety-related responsibilities merit continued attention. The Department faces the diminution of the extensive background and experience in weapons that once resided in contractor organizations. Also, to administer effectively the upgraded approach to safety management advocated by DOE will require highly experienced staff.

The Board has issued a number of formal recommendations addressing this subject, including 90-1, 92-7, 93-2, 93-3, and 93-6. In addition, numerous letters, as well as reports generated by the Board’s technical staff, have been specifically directed to the technical qualifications of DOE’s safety managers. Despite DOE’s actions in this arena, the number of highly qualified technical personnel added to the Department during the 1994-95 period remained minimal.

In January 1996, the Board held a public meeting in Washington, D.C., to address this issue. At that meeting, members of the Board staff who had studied this matter reported the following observations:

- Although DOE had added a number of new hires to its technical staff, most of these were not the senior, highly experienced individuals required for technical leadership roles.
- DOE had elected to conduct its hiring almost exclusively under the more constrained rules of the civil service system, rather than enrich the talent pool through outside recruitment under the excepted service provisions authorized by Congress.

As a result of the January public meeting, a joint DOE/Board conference was held, at which a plan for attacking the critical unmet staffing needs of the Department was addressed. Two members of the Board and the Under Secretary of Energy, along with senior representatives of DOE Headquarters and Field Office Management and members of the Board staff, participated in this conference to focus on developing specific courses of action to address the DOE technical expertise issue. As a result of the conference, a plan to attack the critical staffing needs of the Department and to improve its cadre of Senior Technical Safety Managers was initiated by the Under Secretary.

A key action item resulting from the conference was to have Operations Office managers and Headquarters line management review their organizations and identify the required senior technical safety management positions (existing, as well as those that should be created). Approximately 250 such positions were identified.

A second key action item was for DOE to increase substantially its use of existing excepted service authority. By the end of 1996, DOE had filled a total of 59 excepted

service positions, with another 22 in various stages of recruitment and staffing.⁴ Since DOE's authorization to fill 200 technical excepted service positions expires in October 1997, it is imperative that DOE give prompt attention to these efforts.

Despite encouraging signals from the conference, however, DOE is still experiencing difficulties in meeting its goals. Therefore, a second joint conference is tentatively scheduled for the spring of 1997. Given the expected long-range nature of any solution to this issue and the need to maintain the momentum represented by these initial actions, the Board will undoubtedly be required to sustain its active participation on a continuing basis.

Through efforts related to the joint conference, DOE has addressed issues associated with standards for various management-level technical positions, and a revision to the radiological protection standard is in process. Nevertheless, the Board believes that qualification standards in several other functional areas are marginal, and most of the standards require specific improvements. Further, and of perhaps greater importance, approved training activities and acceptable equivalencies to meet competencies identified in technical qualification standards have not yet been fully identified, developed, or promulgated.

It is not clear that this program will accomplish its objective, especially in a DOE environment in which increasing demands are placed on a dwindling staff. However, the Board remains intensely interested and intends to monitor the effectiveness of the program closely.

Finally, a success story can be reported in this area of interest. As a result of the Board's continuing emphasis on DOE's lack of adequate numbers of highly qualified technical personnel, the Richland Operations Office (DOE-RL) identified a need for added technical strength in the areas of radiological control and nuclear safety. The Board strongly encouraged DOE-RL to use the Department's excepted service hiring authority to acquire the necessary "seed" talent.

During the summer of 1996, DOE-RL received more than 300 applications for the eight identified positions and interviewed more than 100 people. The Board's continuing attention to this issue ensured technical competence and demanding interview techniques on the part of the DOE-RL Technical Review Board performing screening of resumes and interviews. As a result of this recruitment effort, eight new hires with substantial technical credentials were added to the DOE-RL staff.

⁴ After considerable effort by both the Board and DOE, the National Defense Authorization Act for fiscal year 1995 had granted the Department 200 additional excepted service employment slots for scientific, engineering, and technical personnel whose duties would relate to safety at defense nuclear facilities.

2.2.5 Status of DOE Functions, Authorities, and Responsibilities Manual for Nuclear Safety (FAR Manual)

DOE continues to experience changes in programs and organization. An important element of these ongoing changes is the delegation of broad operational responsibilities to field organizations. Yet in spite of the reorganization of managerial processes, poor definition of the authorities and responsibilities of DOE staff members continues to be a fundamental weakness affecting the Department's ability to ensure safety. During the past three years, the Board has placed substantial emphasis on the need for DOE to establish a clear definition of roles and responsibilities for nuclear safety within the Department. Departmental changes have outpaced corresponding changes to the FAR Manual, which is therefore out of date.

In July 1995, in response to Recommendation 94-5, DOE committed to delivering an approved, revised FAR Manual by February 1, 1996. In the implementation plan for Recommendation 95-2, this schedule was subsequently revised to mid-September 1996, and a requirement was added that ". . . the Department roles and responsibilities in the FAR Manual . . . be consistent with changes in the safety management organization instituted pursuant to this Implementation Plan." The importance of this issue was also emphasized at the joint DOE/Board conference discussed in Section 2.2.4 above. A specific DOE Action Item arising from that conference addressed the role of the federal employee in the DOE defense nuclear complex, especially the need to reflect ownership of issues related to safety management of Departmental facilities. DOE noted that "this responsibility can be shared, but DOE's portion is not diminished."

An updated draft document, the *DOE Safety Management Functions, Responsibilities and Authorities Manual (FRAM)*, was delivered to the Board in July 1996. The Board provided comments to DOE in mid-August; a revised FRAM was then provided to the Board in October. Based on a review of the revised manual by its staff, the Board concluded that significant deficiencies limit the usefulness of the draft FRAM. In its present form, it cannot act as a stand-alone statement of the Department's assignment of functions, responsibilities, and authorities. Detailed comments were forwarded to DOE. As a result, DOE concluded that the manual cannot be issued until additional details, to be provided by an integrated series of subtier documents (Level 2 FRAMs), are developed. DOE has indicated that this effort cannot be completed before May 1997.

The Board has continued to emphasize the importance it attaches to the issuance of an updated FRAM, and to DOE's ensuring that its line management clearly understands its responsibilities.

2.2.6 Operational Readiness Review Activities

Since its inception, the Board and its staff have carefully reviewed preparations for starting or restarting activities at defense nuclear facilities and the conduct of associated readiness reviews. Confirmation of readiness to proceed is a major element of an acceptable

safety management program as outlined in Recommendation 95-2, *Safety Management*. The Board has made a number of other recommendations that have addressed standards for performance of Operational Readiness Reviews, including Recommendations 90-4, 91-3, 91-4, 92-3, 92-5, and 92-6.

Throughout 1996, the Board and its staff continued to monitor readiness for startup or restart of activities and conduct of readiness reviews throughout the complex, including the following:

- Startup of the evaporator for the New Waste Calciner Facility at the Idaho Chemical Processing Plant
- Draining of highly enriched uranium solutions from tanks in Building 886 and in Building 771, and startup of the Caustic Waste Treatment System in Building 371 at the Rocky Flats Environmental Technology Site
- Nuclear weapons surveillance and disassembly activities at the Pantex Plant
- Dissolving of Mark-31 plutonium targets in F-Canyon at the Savannah River Site to convert plutonium in irradiated targets to plutonium metal for safe interim or long-term storage
- Disassembly of nuclear weapon components and quality evaluation of weapon components at the Oak Ridge Y-12 Plant
- Startup of the Device Assembly Facility at the Nevada Test Site
- Startup of the Tritium Emissions Reduction Facility at the Mound Laboratory and preparations for restart of all tritium activities at Mound as a result of tritium inventory control problems in late 1996
- Startup of a classified program at Los Alamos National Laboratory

In general, the Board continues to observe improvements in preparations by line management for startup or restart of operations and the conduct of readiness reviews.

2.2.7 Operational Radiological Safety

The Board's initiatives during the past five years have led to distinct improvements in radiological control programs throughout the DOE complex. In November 1996, the Board determined that the major purposes of Recommendation 91-6 on improving the DOE program for radiological protection of workers and the public had been met. This recommendation is now closed. However, continued vigilance and strong technical leadership at all levels of DOE management will be required if DOE is to continue to meet its declared goal of excellence in radiological protection performance.

Since its establishment, the Board has advocated improvement in DOE's complex-wide radiological protection program. In addition to monitoring Department-level policy and requirements regarding radiological protection, the Board and its staff have made numerous visits to assess the overall adequacy of site radiological protection programs and the degree of their conformance with existing DOE guidance. In addition, the Board staff has been especially active recently in reviewing the development of DOE's proposed revisions to its radiological protection rule, 10 CFR 835.

During the first year and a half following its establishment, the Board conducted assessments and reviews of radiological protection programs at several DOE defense nuclear facilities. As a result of these efforts, the Board identified significant weaknesses in DOE's radiological protection program and in December 1991 issued Recommendation 91-6, *Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities*. In this recommendation, the Board identified a need for increased DOE attention in five major areas: (1) DOE management and leadership in radiological protection programs, (2) radiological protection standards and practices at defense nuclear facilities, (3) training and competence of health physics technicians and supervisors, (4) analysis of reported occurrences and correction of radiological protection program deficiencies, and (5) understanding of and attention to radiological protection issues by DOE and its contractor organizations.

The Board has consistently urged DOE to improve its radiological protection program and, in Recommendation 91-6, it explicitly encouraged the Department to strive toward excellence in this area. DOE responded to Recommendation 91-6 by strengthening its policies, standards, training, oversight, and organizational infrastructure for the Department-wide radiological protection program. In June 1992, partly in response to Board urging, DOE incorporated mandatory radiological controls, requirements, and practices in its newly issued *Radiological Control Manual*. Late in 1993, DOE codified its radiological protection requirements in 10 CFR 835, which included as-low-as-reasonably-achievable (ALARA) provisions.

As part of the 1995 consolidation of its health and safety orders, DOE redesignated the *Radiological Control Manual* as simply a guidance document, covering any gaps left by this action with pertinent requirements contained in DOE Notice 441.1, *Radiological Protection for DOE Activities*. The Board found that these standards provide an adequate framework for an acceptable occupational radiological protection program. The guidance thus promulgated is consistent with standards applicable to the commercial nuclear industry.

During 1996, the Board conducted assessments of work planning practices, with particular attention to radiological protection programs at the Hanford Site, the Rocky Flats Environmental Technology Site, the Los Alamos National Laboratory, the Idaho National Engineering Laboratory, and the Oak Ridge Y-12 Plant. The greatest emphasis was on the Hanford Site, where deficiencies in the radiological protection program are long-standing, and where a continuing lack of both management attention and technical expertise was

evident. Considerable improvement in the level of technical expertise at Hanford resulted (see Section 2.2.4 above).

The Board and its staff also reviewed proposed changes to the rule on *Occupational Radiation Protection*, 10 CFR Part 835. Among the issues raised by the Board staff and resolved by DOE were dose limits, use of the terms "survey" and "monitoring," and requirements for calibration of equipment such as air samplers. DOE published an amendment to 10 CFR 835 for public comment in late December 1996. The Board will continue to work with DOE staff during the public comment period, staying abreast of comments, their resolution, and changes made in the final rule.

2.2.8 Health Effects of Plutonium Uptake by Workers

The Board has been influential in arranging for the reactivation of and a modest increase in funding for a long-term study of individuals who have received known radiation exposures from internal deposition of plutonium. Affected individuals were examined every five years from 1951 through 1991. The target group includes nineteen surviving workers (seven others have died) who were exposed during the time they worked at Los Alamos National Laboratory in the early days of the nuclear arms race.

The forty-year study of known and measurable plutonium deposition in these individuals constitutes hard evidence that the radioactive element is not as hazardous as generally believed. Reacting to criticism that DOE lacked public credibility, DOE's Office of Environment, Safety and Health (ES&H) transferred the study from Los Alamos National Laboratory to the Department of Health and Human Services' National Institute for Occupational Safety and Health (NIOSH). Two years later, NIOSH decided to drop the program, alleging that it was too small to be statistically significant, and ES&H subsequently decided not to fund it.

In response to urging from the Board and action by Under Secretary Thomas Grumbly when he was informed of the situation, DOE has once again resumed the study, under the direction of Dr. George Voelz, an internationally recognized expert, who had directed the study from 1970 through 1988. A funding level of \$90,000 is earmarked for this work during fiscal year 1997, but none is currently available for fiscal year 1998. The Board believes that adequate funding should be made available to continue the health studies of the remaining former employees with known plutonium contamination.

2.3 ACTIVITIES RELATED TO DECONTAMINATION AND DECOMMISSIONING

As DOE's mission has changed from production to cleanup, the Board has increased its attention to the decommissioning of production facilities. This shift has included greater emphasis on the safety standards to be used during decommissioning and closer scrutiny of programs aimed at ensuring the health and safety of workers, as well as the offsite public,

during the stabilization and deactivation phases of decommissioning (see Section 2.5 for a discussion of stabilization of residual radioactive materials). DOE initiatives to develop pilot programs on enhanced work planning are designed to involve workers along with safety professionals in work planning. These pilot programs are leading to improved safety awareness and to incorporation of appropriate safety measures in work plans.

The Atomic Energy Act requires the Board to review and evaluate the content and implementation of standards (including applicable DOE orders, regulations, and requirements) relating to the design, construction, operation, and decommissioning of each DOE defense nuclear facility. Decommissioning commences in earnest when DOE determines that facilities are no longer needed to support the weapons program; the facilities are then scheduled for deactivation and eventual dismantlement or reuse. The Board has defined terms related to decommissioning and clarified its jurisdiction and responsibilities during the decommissioning process in its policy document PS-3 and its technical report on *Regulation and Oversight of Decommissioning Activities at Department of Energy Defense Nuclear Facilities* (DNFSB/TECH-12).

As described in these documents, decommissioning has different meanings for different agencies. In the context of Board oversight of a DOE defense nuclear facility under the Atomic Energy Act, decommissioning starts at the end of operations and ends when radioactive materials have been adequately removed from the facility. DOE, for its own purposes, has broken down the period following operations into phases such as stabilization, deactivation, and decommissioning. Although this has caused no conflicts, clarification of terms is needed for jurisdictional purposes. The above documents also clarify that, regardless of the term applied to the phases in the life of a facility, the Board's interest follows the hazards to worker and public health and safety posed by the radioactive materials involved.

DNFSB/TECH-12 goes on to describe the interactions that occur among the Board and other regulators as a facility progresses through decommissioning (from operations to environmental restoration). Board interest in a facility diminishes as radioactive hazards are removed, whereas Environmental Protection Agency (EPA) and state interests increase as the facility progresses through cleanup to environmental restoration and release for limited or unrestricted use. DNFSB/TECH-12 suggests principles of cooperation to streamline the transition and minimize the impact of multiple regulators on DOE activities.

On the basis of understandings with EPA and associated state authorities, DOE is proceeding to decontaminate excess facilities to the extent required to maintain and monitor them safely until they can be dismantled or converted to other uses, and environmental restoration can be accomplished under provisions of the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or applicable state statutes as appropriate. Provisions of those statutes bring such actions under the oversight of EPA and/or the affected states, as well as the Board.

In keeping with its interest in following hazards to the health and safety of workers and the public, the Board has focused its attention with regard to deactivation and decommissioning primarily on the Rocky Flats Environmental Technology Site (RFETS), the Hanford Site, and the Savannah River Site—three locations DOE has selected for early cleanup:

- At RFETS, work is under way to develop new methods for deactivation and decommissioning of facilities, and to streamline processes for getting this work done much more rapidly than the ten-year span previously projected.
- At the Hanford Site, DOE has identified deactivation projects involving the Uranium Trioxide (UO₃) and PUREX facilities as models for the development of common deactivation practices. Deactivation of the B-Plant will use the models developed by these facilities. DOE has identified the C-Reactor at the Hanford site as the centerpiece of a large-scale demonstration project for development of new decommissioning technologies, including placement of the reactor in a cocoon.⁵
- At the Savannah River Site, the Board has only recently initiated contacts to examine planning activities and their application to near-term facilities for decontamination and decommissioning.

To avoid duplication of the regulation and oversight of decommissioning, the Board, along with DOE, EPA, and the State of Colorado, developed a Memorandum of Understanding (MOU) that coordinates their respective oversight and regulatory authorities during the cleanup of RFETS. Coordinated efforts under such an MOU should minimize the impact of multiple regulators on DOE activities, while accommodating each agency's statutory mandate. Specifically, one agency with jurisdiction over a given DOE activity takes a primary role, and the other regulatory or oversight agencies with jurisdiction or special expertise take secondary roles, advising the primary agency or working through that agency to discharge their jurisdictional responsibilities. The MOU neither expands nor diminishes statutory powers, and DOE need only work directly with one agency and follow a set of consolidated and agreed-upon requirements. DOE, EPA, the State of Colorado, and the Board executed the RFETS MOU in February 1996. It was then issued as an appendix to the final Rocky Flats Cleanup Agreement.

The Board has pursued cooperative arrangements with other states that have DOE sites involved in substantial decommissioning activities. For example, the Board is now working with the State of Tennessee and DOE to establish an informal protocol to ensure that CERCLA activities at the Oak Ridge National Laboratory Molten Salt Reactor

⁵ This technique involves extending all reactor shield walls to the same height and adding a new concrete roof above the reactor, modifying the reactor building to seal all penetrations and most other building access points, removing all ancillary buildings and structures, and allowing only infrequent and limited access to the facility for periodic inspection.

Experiment are coordinated with the Board's health and safety activities. Close cooperation among the parties should help prevent duplication and negative impacts on the DOE cleanup schedule. This protocol may be expanded, as mutually agreed, to accommodate future decommissioning activities at Oak Ridge.

2.3.1 Rocky Flats Environmental Technology Site

The Board has identified Building 771 at RFETS as one of the highest-priority facilities in the DOE nuclear weapons complex to be inventoried for decommissioning. Plutonium processing and research and development in the building have been shut down since 1989. Under DOE's planning, deactivation is scheduled to begin during fiscal year 1998, with decommissioning due to start two years later. Many of the processes carried out in Building 771 involved weapons-grade plutonium dissolved in strong acid solutions. On a number of occasions in the past, these solutions have leaked from equipment and contaminated various areas of the building. A significant amount of plutonium is held up in the production equipment, including gloveboxes, ventilation ducting, filters, and inaccessible areas. More than 10 kilograms (kg) of plutonium is held up in ductwork alone, with unknown quantities in equipment, tanks, and piping.

Building 779, previously used for research and development of processes for handling special nuclear materials, is to be a pilot project for deactivation of other high-hazard buildings. Deactivation, which is expected to last about three years, is presently under way with removal of special nuclear materials and remaining chemicals. Deactivation and decommissioning will overlap, with dismantlement of process equipment due to begin in March 1997.

2.3.2 Hanford Site

Deactivation of the Uranium Trioxide (UO₃) Facility. The UO₃ Facility was formerly used to convert uranyl nitrate hexahydrate solution from the PUREX Plant into UO₃ powder. The facility's last operating campaign was completed in June 1993, after which deactivation began immediately.

Deactivation of the UO₃ Facility is intended to establish a passively safe and environmentally secure configuration and to preserve that configuration for up to ten years. DOE considers the project to be completed. Currently, the plant is unoccupied and contains no portable equipment or furniture. Nearly all radioactive or hazardous materials have been removed. Only minimal effort is required for surveillance and maintenance activities. All process equipment, instrumentation, and systems for heating, ventilation, and air conditioning have been shut down. The building doors and gates in the perimeter fence are locked to limit access. The facility is entered only to conduct quarterly surveillance visits or to correct deficiencies identified during previous surveillance entries.

The Board completed a review of the authorization basis for the UO₃ Facility applicable during this period of the facility's life cycle and found that for the near term, the

existing framework of implementation and safety management provides adequate protection for workers, the public, and the environment. However, the environmental restoration contractor has not demonstrated that long-term surveillance and maintenance activities will provide the same level of protection. Furthermore, the ability to plan adequately for and manage an emergency situation has not been demonstrated.

The PUREX Facility and the B-Plant. The PUREX Facility processed irradiated fuel from the Hanford production reactors for the recovery of plutonium and uranium between 1956 and 1972. It was restarted in 1983 and continued to operate until 1990. The B-Plant had several functions during its 50-year life, the most recent of which was the removal of cesium and strontium from high-level radioactive waste.

DOE intends for PUREX to follow a deactivation process similar to that used at the UO₃ Facility. The deactivation of PUREX neared completion during 1996, and DOE expects completion by early 1997. Deactivation of the B-Plant is scheduled to begin during 1997, following the model developed for the UO₃ and PUREX facilities (see Section 2.4.4).

The C-Reactor. The C-Reactor is a surplus production reactor originally scheduled to be the first of eight to be dismantled at the Hanford Site. In lieu of dismantling, DOE now intends to place the C-Reactor in a cocoon for a period of up to 75 years before dismantlement is completed.

C-Reactor cocooning consists of demolishing and removing or burying all the structures and the fuel pool, with the exception of the walls immediately surrounding the graphite reactor block. The reactor block and walls are then to be sealed and capped for the long term.

DOE expects that this method will provide a safe storage mode during this extended period and reduce the risks and costs of prolonged maintenance. In addition, DOE believes that the use of a cocoon could demonstrate technology improvements with the potential to reduce cost, improve safety, and lessen environmental liabilities within the DOE complex. Technologies developed at the C-Reactor could be transferred quickly to other Hanford facilities, where similar reactors and dozens of other large facilities require action, as well as to facilities elsewhere in the defense complex.

105-N Basin Cleanout. The N-Reactor is a surplus dual-purpose production reactor that operated from 1963 through 1987. The 105-N Basin contained irradiated fuel assemblies discharged from the N-Reactor during its operating lifetime. In 1989, the reactor was completely defueled, and all remaining spent fuel was removed from the basin. Debris removal began in 1995 and currently continues. Debris remaining in the basin includes highly radioactive hardware (greater than 1 rad per hour on contact) that was irradiated in the reactor, basin sediment, and basin water.

The Board staff observed basin cleanout activities during 1996 and reviewed applicable safety documentation. These reviews, as well as assessments completed by DOE

and other independent reviews, identified weaknesses in the contractor's safety documentation. Hazard and safety analyses made assumptions that could not be fully supported, and the adequacy of protective measures in place was questionable. Subsequently, the contractor reverified and formalized its safety controls under the scrutiny of DOE. The Board continues to monitor these activities as the contractor upgrades safety documentation and continues 105-N Basin cleanout.

2.4 ACTIVITIES RELATED TO DESIGN, CONSTRUCTION, AND INITIAL OPERATIONS

While the overall budget and manpower of the DOE defense nuclear complex are shrinking, there are still several large construction projects under way or in advanced planning stages. In some cases, new facilities are needed to ensure the safety and reliability of existing nuclear weapons and to provide component testing capabilities in the absence of future underground nuclear testing. Other new facilities are needed to stabilize and store large quantities of high-level nuclear waste, plutonium, and other hazardous legacies of the production of nuclear weapons.

The Board's statutory mission includes responsibility for reviewing the design of new defense nuclear facilities, monitoring the construction of new facilities, and making health and safety recommendations to the Secretary of Energy related to new construction. This obligation applies not only to altogether new, free-standing facilities, such as the Actinide Packaging and Storage Facility at the Savannah River Site (described below), but also to substantial modifications of existing facilities. In many cases, ambitious remodeling of old facilities, such as the Chemistry and Metallurgy Research Building at Los Alamos National Laboratory and Building 371 at Rocky Flats, will be more difficult technically than construction of completely new buildings.

2.4.1 Savannah River Site

In-Tank Precipitation (ITP) Facility. The ITP Facility is a pretreatment facility used to concentrate and remove radioactive fission products from high-level waste liquids. The separated fission products will be processed at the Defense Waste Processing Facility. The decontaminated liquids are to be processed at the Saltstone Facility.

In the ITP process, tetraphenylborate is added to the contents of a waste storage tank, causing cesium and certain other fission products to precipitate out of the liquid waste. During the process, chemical and radiolytic decomposition of the tetraphenylborate occurs, liberating substantial quantities of highly flammable benzene. Test results suggest that the precipitated cesium and potassium tetraphenylborate solids, as well as the excess tetraphenylborate in solution, may also be vulnerable to rapid decomposition by catalytic attack. If the precipitated solids should decompose, the resulting benzene release could be very large indeed. Such an event would pose a major flammability hazard.

This potential hazard was a key factor in the Board's decision to issue Recommendation 96-1, *In-Tank Precipitation System, Savannah River Site*, in August 1996. The Board strongly urged DOE not to proceed with large-scale process testing in the ITP Facility until the mechanisms by which flammable gases are generated, retained, and released in the ITP process are better understood, and appropriate safety measures to prevent a deflagration are in place.

The Board's review of the safety basis for ITP disclosed further that the maximum percentage of oxygen permitted in the vapor space in the tank was inadequately justified. The tank involved (Tank 48) has an inerting system intended to keep the percentage of oxygen in the vapor space below the minimum concentration required to support combustion. However, the percentage of oxygen required for combustion varies for different admixtures of gases, and the safety evaluation for ITP did not show whether the chosen oxygen limit was appropriate for the gas compositions that could exist in Tank 48. When informed of this problem, Savannah River Site personnel performed additional calculations to justify the limit, updated the safety evaluation, and added a new control on tank operations to prevent hydrogen from accumulating to a concentration that would invalidate the new analysis.

The output from the ITP Facility will eventually serve as another feed stream to the Defense Waste Processing Facility, where high-level waste is vitrified. The latter facility is currently operating and has enough feed material to operate for several years before the output from ITP will be needed.

The Board regards process safety at ITP as one of the highest-priority issues in the complex. The combination of benzene and high-level waste being created at ITP is a unique hazard that will need to be carefully analyzed and controlled, and the potential problem has not yet been fully resolved. The Board is closely monitoring DOE's efforts to characterize ITP's chemical process to ensure that sufficient understanding is developed to support safe operations. The Board is also carefully evaluating safety systems being developed for ITP to ensure that process controls are adequate, and that preventive and mitigative controls will protect facility workers and the public from undue risk.

Actinide Packaging and Storage Facility. A new Actinide Packaging and Storage Facility is to be constructed at the Savannah River Site. This new facility will be required to meet the storage standard for plutonium metal and oxide discussed in Section 2.2.2. It will incorporate plutonium stabilization and packaging equipment, along with sufficient vault space to permit extended interim storage of the site's plutonium. In a recent Record of Decision, DOE stated its intention to store up to 10 metric tons of surplus plutonium in the expanded Actinide Packaging and Storage Facility. This facility will also store plutonium from the Rocky Flats Environmental Technology Site, as well as material already at the Savannah River Site.

Conceptual design documentation for the facility was completed during 1996; detailed design will begin in the second quarter of 1997. Construction is scheduled to start at the end of 1998 and to be completed by 2001. During 1996, the Board staff reviewed the

safety aspects of the conceptual design documentation; safety aspects of the detailed design will be reviewed during 1997.

2.4.2 Rocky Flats Environmental Technology Site

In 1993, DOE formulated plans for the consolidated storage of special nuclear material in Building 371 at the Rocky Flats Environmental Technology Site. The Board reviewed the design of the building, including its capacity to withstand external forces from natural phenomena (e.g., earthquakes and high winds). Based on its reviews, the Board concluded that activities to prepare Building 371 for an extended storage mission were neither logical nor sufficiently broad in scope to ensure protection of the health and safety of the public and workers since, in due course, Building 371 will contain a large part of DOE's supply of plutonium.

In Recommendation 94-3, *Rocky Flats Plutonium Storage*, the Board urged DOE to use systems engineering methods in the development of an integrated plan for addressing the civil engineering, structural, and seismic safety issues and evaluations related to the planned use of Building 371. In October 1995, DOE completed an analysis which determined that the building could be made structurally adequate provided several structural upgrades were performed. In September 1996, the Board accepted an integrated program plan that requires the completion of required upgrades to those structures, systems, and components which provide safety functions; the development of a safety management program; and the initiation of actions toward DOE's preferred alternative of constructing an interim storage vault in lieu of using Building 371. In late 1996, the structural upgrades were designed and installed, thus making the building structurally adequate for the interim storage mission.

2.4.3 Los Alamos National Laboratory

Capability Maintenance and Improvement Project and Upgrades to Technical Area-55 and the Chemistry and Metallurgy Research Building. The objectives of the Capability Maintenance Improvement Project are to (1) improve the capability to carry out current missions by maintaining and improving facilities and (2) develop the capacity for limited-scale manufacturing of plutonium pits for nuclear weapons. The project involves Technical Area-55 (TA-55), the Chemistry and Metallurgy Research Building, and some non-nuclear facilities and infrastructure. The cost of the program is expected to be about \$360 million. The conceptual design report is expected to be completed in early 1997. The Board has conducted an initial review of the Capability Maintenance and Improvement Project and the planned upgrades to the Chemistry and Metallurgy Research Building to identify any safety-related issues. The need to specify more clearly the roles and responsibilities at the Los Alamos National Laboratory was highlighted to laboratory management. Also, since some assumed scenarios regarding safeguards and security have the potential to affect safety within nuclear facilities, the importance of clarifying requirements for safeguards and security early in the design process was noted.

Upgrades to the Nuclear Materials Storage Facility at Technical Area-55. The Nuclear Materials Storage Facility is to be upgraded and used for storage of special nuclear material needed at the Los Alamos National Laboratory. To date, no special nuclear material has been stored at the facility, and major modifications are needed to make the facility usable. In its review of the conceptual design for the upgrades to the facility, the Board identified several issues, including potentially out-of-specification placement of reinforcing steel in the concrete walls. As a result of this review, cognizant personnel at the laboratory have developed a plan to resolve the flawed conditions. Replacement of some structural members may be required.

Integrated Safety Management and Authorization Basis. The Board has reviewed the Los Alamos National Laboratory's progress in developing an integrated safety management system for TA-55 and has had a number of informal discussions in this regard with laboratory management. Technical management approaches to reviewing proposed activities, including analyses of process hazards, continue to be reviewed. TA-55 management has been encouraged to place increased emphasis on risk reduction. In addition, specific issues related to safety management have been evaluated. For example, the Board staff noted that the laboratory does not have an adequate electrical safety program. The Board expects such a program to be incorporated into the integrated safety management system under development. The Board staff also identified a need for operating limits related to degradation of the system supplying water for fire suppression.

2.4.4 Hanford Site

In late 1995, DOE began deactivating the B-Plant at the Hanford Site. This facility was used in several defense production and waste management missions during its 50-year life, the last being the removal of cesium and strontium from high-level radioactive waste stored in the Hanford tanks.

The Board's review of the B-Plant found that over the lifetime of the plant, a large amount of radioactive material had been deposited on the operating high-efficiency particulate air (HEPA) filter in the exhaust ventilation system. The filter unit in use at the time of the Board's evaluation showed signs of degradation due to its age and the resulting exposure to radiation. A new unit was made available for service after appropriate checkout and testing. Three previously retired filter units were also heavily contaminated with radioactive material. Although these three units were isolated by water seals, such seals do not provide a reliable means for isolating airborne radioactivity.

Although DOE and its contractors had previously discussed retiring the degraded filter, it remained in service. When the Board pointed out the safety issues involved, which were documented in a report prepared by the Board staff, DOE removed the filter from service and placed the new unit in operation. DOE also decided to construct a new exhaust filter system to bypass the existing system, and to replace the water seals with physical barriers. These actions significantly reduced the potential for a radiological release to the environment in the event of a failure of the operating exhaust filter unit.

2.4.5 Gaseous Diffusion Plants at Oak Ridge, Portsmouth, and Paducah

Approximately 50,000 cylinders containing more than 500,000 metric tons of depleted uranium hexafluoride (UF_6) gas 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 these cylinders had not been maintained and that many cylinders were being handled and stored under conditions that could lead to increased breaching of the cylinders. To protect against further cylinder breaches and the resulting potential for dispersion of large amounts of UF_6 to the environment, the Board issued Recommendation 95-1, *Improved Safety of Cylinders Containing Depleted Uranium*, in May 1995, recommending that DOE address the problem promptly. The Secretary of Energy accepted the Board's recommendation and submitted an acceptable implementation plan in October 1995.

During 1996, the Board reviewed DOE's progress in implementing Recommendation 95-1, and found that significant actions have been taken to slow the degradation of cylinders. Substantial progress has been made in several areas, including removing cylinders from direct ground contact, painting the areas of cylinders most vulnerable to corrosion, completing design and construction of several new and improved cylinder storage yards, and establishing a pilot program at the Paducah Gaseous Diffusion Plant to demonstrate a method for recoating entire cylinders (approximately 1,500 cylinders have been recoated under this pilot program).

The actions of DOE in 1996 indicate an understanding of the intent of Recommendation 95-1. While significant action has been taken, more remains to be done, including the establishment of cylinder coating programs to recoat cylinders in storage at all three sites. The Board will continue to monitor DOE's progress toward implementation of Recommendation 95-1.

2.5 ACTIVITIES RELATED TO PLUTONIUM STABILIZATION

In the Board's early years, stabilization of plutonium and other nuclear raw materials was not a prominent issue. During the era of active weapons production, plutonium and other weapons materials were in demand as feed materials. Any plutonium-rich scrap from weapons fabrication processes was quickly recycled. When older weapons were retired and disassembled, the plutonium they contained was quickly reused for the production of new weapons. Only small amounts of plutonium or plutonium-rich scrap were ever allowed to remain in storage for more than a few months. This situation changed dramatically starting in 1989.

DOE shut down weapons production activities at many defense nuclear facilities during the period from 1989 to 1992. In most of those facilities, substantial quantities of plutonium, uranium, and irradiated fuel were in storage awaiting processing. In many cases,

the storage configurations were intended to be temporary and were not considered safe for long periods of time. Plutonium in reactive forms or in temporary, unsealed containers needed to be converted to stable metallic or oxide forms and placed in durable, sealed containers. Irradiated fuel needed to be removed from temporary storage in water basins, and converted to stable forms for long-term storage.

In order to deal with the wide scope of the material instability problem, the Board issued Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Complex*, which called for an aggressive timetable for removing plutonium and irradiated fuel from temporary storage and placing the materials in stable forms for safe long-term storage.

The implementation plan for Recommendation 94-1 also calls for stabilization of solutions containing other actinides. These actinide solutions are chemically unstable and readily dispersible. Stabilization has required restarting certain processes in older facilities, as well as installing new processing capability in some other facilities. The Board's close and continuing attention to facility preparations and stabilization activities and DOE's response to Recommendation 94-1 have led to the following key accomplishments:

- Operation of F-Canyon and FB-Line at the Savannah River Site and stabilization of about 50,000 gallons of plutonium solutions
- Dissolution of approximately 138 metric tons of deteriorated Mark-31 plutonium targets in F-Canyon for conversion to stable metal in FB-Line
- Expedited preparations for restart of the Savannah River Site H-Canyon and HB-Line to support stabilization of plutonium and neptunium solutions
- Progress in a development program for vitrification of the highly radioactive americium/curium solutions in F-Canyon and the neptunium solutions in H-Canyon
- Continuation of hydroxide precipitation processing of plutonium solution in Buildings 771 and 371, startup of the Caustic Waste Treatment System, and preparation for the start of oxalate precipitation processing at the Rocky Flats Environmental Test Site
- Processing of all highly enriched uranium solution at the Rocky Flats Environmental Technology Site
- Development and testing of a prototype vertical calciner at Hanford's Plutonium Finishing Plant to process plutonium-bearing solutions

The following subsections detail activities and issues related to plutonium stabilization at the Savannah River Site, the Rocky Flats Environmental Technology Site, and the Hanford Site.

2.5.1 Savannah River Site

In Recommendation 94-1, the Board urged DOE to expedite processing of deteriorating Mark 16 and Mark 22 aluminum-alloy spent fuel stored in basins at the Savannah River Site. In its implementation plan for this recommendation, DOE committed to begin stabilizing the fuel by November 1996. Although DOE had planned to conduct additional studies of the feasibility of dry storage, the Board pointed out problems involved in pursuing these dry storage plans and identified other rapidly corroding nondefense fuel that had previously been predicted by DOE to remain stable for another ten years. In an earlier technical report, the Board had established the technical basis for concluding that stabilization of the fuel by chemical separation is a better alternative. The Board's attention to this matter contributed to a DOE decision to stabilize this particular spent fuel by processing it in the Savannah River Site canyon facilities.

The conversion of the fuel into more manageable components (i.e., feed for the Defense Waste Processing Facility and low-enriched uranium) did not begin on the desired schedule. A delay in processing of the material resulted from a DOE and contractor review of the adequacy of the seismic analyses of the F- and H-Canyons. The Board and its staff participated in an aggressive review of the analytical effort and supported a DOE decision to resume processing in the F-Canyon. A decision on the adequacy of the H-Canyon was pending at year's end (it has since been determined that the H-Canyon is sufficiently robust for this use). A revised schedule for conversion of this fuel is being actively reviewed with DOE.

2.5.2 Rocky Flats Environmental Technology Site

Minimizing of Explosive Potential. In November 1994, a review by the Board concluded that certain tanks containing plutonium solutions at the Rocky Flats Environmental Technology Site might not be adequately vented and that explosive amounts of hydrogen could be accumulating. This conclusion was substantiated by independent analysis performed by the Board staff in March 1995. At the urging of the Board, DOE took gas samples from several of the tanks. These samples confirmed that hydrogen was present at concentrations up to 15 times the minimum explosive limit. In January 1996, the Board requested that DOE take more aggressive action to resolve this issue. DOE and the Rocky Flats contractor then took corrective action to sample and adequately vent the tanks of concern. Within nine months of the Board's letter, all 84 tanks had been sampled, and the 19 tanks that had contained excessive concentrations of hydrogen gas had been purged. DOE is continuing to evaluate further actions needed for piping and other tanks containing contaminated organic solutions that may also contain hydrogen gas.

Resumption of Plutonium Operations. Stabilization of plutonium solutions has required restarting hydroxide precipitation in Building 771, as well as installing the Caustic Waste Treatment System in Building 371.

In accordance with the Board's statutory responsibility, plutonium operations in specific Rocky Flats buildings may not resume until the Board determines to its satisfaction that DOE's response to identified Board recommendations adequately protects public health and safety. To fulfill this requirement in this instance, the Board conducted thorough reviews of the design, process hazards, building authorization bases, formality of operations, and other related topics that support plutonium operations. Before the Board reported favorably, DOE addressed several safety issues raised by the Board concerning such matters as worker safety controls, fire protection, and demonstration of safety basis implementation.

Hydroxide precipitation of uranium and plutonium solutions began in November 1996 and should continue through the spring of 1997. The Caustic Waste Treatment System began operations in December 1996 and will be processing solutions from tanks and pipes through 1999. The Board has initiated its review of the oxalate precipitation process that will be used to stabilize the remaining high-concentration plutonium solutions in Building 771 starting in late 1997.

Board review and deliberation on resumption of other plutonium operations (e.g., stabilization processes for plutonium oxide and solid residues, discussed below) will also be conducted during 1997.

Stabilization of Plutonium Oxide. In Recommendation 94-1, the Board recommended that DOE expedite preparations for repackaging plutonium metal in contact with plastic, and for packaging all plutonium metal and oxide in accordance with the plutonium storage standard under development at that time (see Section 2.2.2). In addition, for some time the Board has urged DOE to raise the temperature used in thermal stabilization of plutonium oxide at Rocky Flats.

Plutonium metal known to have been stored originally in direct contact with plastic has been repackaged. Subsequently, a few additional packages containing plutonium in contact with plastic have been identified; as they are discovered, corrective action is being taken. DOE has designated Rocky Flats as the site for a pilot plutonium stabilization and repackaging line, which will provide for storage of plutonium metal and oxide in a manner that complies with the plutonium storage standard. This process line will be delivered soon and is expected to be operational by next summer. Finally, the Rocky Flats contractor has been able to raise the thermal stabilization temperature to 1000°C using existing equipment, consistent with the plutonium storage standard, and the backlog of plutonium oxide has been stabilized.

Stabilization of Solid Residues. In 1996, the Board completed an in-depth technical evaluation of the safety risks of storing solid materials contaminated with plutonium, and developed a priority ranking for those materials, referred to collectively as "solid residues,"

which are now in vented drums at Rocky Flats. Solid residues posing the highest risk include such items as ion-exchange resins, leaded glovebox gloves, wet combustibles, and filters. Based on its evaluation, the Board concluded that significant hazards remain.

Early treatment of ion-exchange resins and leaded glovebox gloves was essentially completed in 1996. The final methods to be used for processing and stabilizing wet combustible residues are only now under development by DOE. As part of its response to Recommendation 94-1, DOE recently conducted detailed studies of alternative methods for processing of wet combustibles and other high-risk residues. As a result of these studies, DOE now plans to change its proposed methods for treating solid residues, and that is likely to delay schedule commitments in the implementation plan for Recommendation 94-1. The Board continues to follow the development of trade-off studies and their effects on the design of processing systems for solid residue processing systems. The Board has strongly encouraged DOE to minimize the impact of any such design changes on the schedules for processing this material, which becomes more hazardous as time passes.

2.5.3 Hanford Site

Plutonium Stabilization. Recommendation 94-1 led to several activities at the Hanford Site to stabilize, repackage, and store or dispose of plutonium-bearing materials. Most of the plutonium-bearing materials at Hanford are located at the Plutonium Finishing Plant; many of these materials exist as unstable oxides and in other chemical forms unsuited for long-term storage. The Department's implementation plan for Recommendation 94-1 calls for stabilization of urgent-risk materials by May 1997 and remaining at-risk materials by May 2002.

In addition to the above, significant stabilization activities at the Plutonium Finishing Plant during 1996 included the following:

- Completion of characterization of the plutonium inventory, which includes six physical and chemical categories of plutonium-bearing materials. This was done by x-ray radiography, which identified at-risk containers that were then repackaged to meet current interim storage criteria.
- Cementation of several kilograms of plutonium-bearing residues that were collected during facility cleanout and placed in more than 500 polyethylene jars for disposal.
- Continued operation of furnaces to stabilize plutonium metal and oxides to meet the thermal stabilization criterion specified by the DOE Standard *Criteria for Safe Storage of Plutonium Metals and Oxides*, DOE-STD-3013-94.

The Board and its staff will continue to monitor the stabilization activities at the Plutonium Finishing Plant throughout 1997 to ensure that adequate progress is made in reducing the health and safety risks posed by the plutonium-bearing materials at the plant.

Spent Nuclear Fuel Project for the K-Basins. At the beginning of 1994, DOE pursued a vaguely defined course of action to resolve the recognized safety issues of severely deteriorated spent fuel stored in leaking basins located next to the Columbia River. DOE had committed to removing fuel from these K-Basins by the end of the year 2002, although DOE-Headquarters expressed reservations about the feasibility of meeting that completion date. In early 1994, the Board pointed out the lack of a technical basis for DOE's planned course of action and urged DOE to identify engineering alternatives, the criteria for selecting an alternative, and the anticipated radiological consequences of proposed actions. In May 1994, the Board issued Recommendation 94-1, specifically recommending that the program be accelerated to place the deteriorating spent fuel in a stable configuration for interim storage until an option for ultimate disposition is chosen. As a result of intense interactions between DOE and the Board and its technical staff, DOE's implementation plan committed to initiating fuel removal by the end of 1997 and completing it by December 1999.

The Board was instrumental in steering both the contractor and DOE toward a system in which all activities associated with the stabilization of the fuel in the K-Basins would be conducted on an integrated project basis. Project engineering studies identified stabilized dry storage as the best interim storage method for the type of fuel stored in the K-Basins. Characterization tests for spent fuel and sludge are in progress in hot cell laboratories to determine the appropriate fuel conditioning processes and the necessary facilities for stabilization of the fuel. Construction started in 1996 on a Canister Storage Building to provide interim storage for the stabilized fuel.

The Board and its technical staff have continually and aggressively reviewed these project activities, and have encouraged the timely implementation of consistent design criteria for the Canister Storage Building. The Board's involvement with these issues contributed significantly to DOE's development of a technically sound path forward and an expedited schedule for resolving the safety and environmental vulnerabilities associated with the leaking fuel. The Board will continue to encourage timely completion of the project activities as facility design and construction are completed and preparations for operations intensify in 1997.

2.6 ACTIVITIES RELATED TO WASTE MANAGEMENT

After decades of production of nuclear materials and weapons, DOE is now faced with the daunting task of cleaning its sites of radioactive and other hazardous wastes left behind. The Board considers oversight of DOE's activities in this regard one of its highest priorities. Since the Board's inception, it has made several recommendations to the Department addressing deficiencies in characterizing, processing, and ultimately disposing of wastes. These recommendations have a common theme in that they request DOE to understand the problem fully, and then to take a systematic approach to solving it. DOE's actions have met with varying degrees of success. While understanding has improved and much progress in remediation has been made, significant work must still be done. This work

will remain a strong focus of Board activities in 1997 and well into the future. Several activities related to these efforts are detailed in the following subsections.

2.6.1 Implementation of Recommendation 94-2

Recommendation 94-2, *Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites*, was issued in September 1994. It 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 identify suitable corrective actions. DOE's implementation plan for this recommendation organized overall efforts into six areas: (1) systems engineering, (2) a complex-wide vulnerability assessment, (3) a study of DOE's regulatory structure and process, (4) performance assessments, (5) projections, and (6) research and development.

Originally, the implementation plan called for all work to be completed by August 1997, with most activities completed by late 1996. DOE made little initial progress toward achievement of this schedule. In response to prompting by the Board and recognizing that its original schedule was overly optimistic, DOE redirected its efforts in late 1995, with the aim of reassessing existing commitments and formulating a new strategy that would be more consistent with available funds and technical resources. This effort culminated in April 1996 with the issuance of a revised implementation plan, which was subsequently accepted by the Board.

To date, all deliverables scheduled for completion under the revised plan have been completed and provided to the Board on schedule. All deliverables reviewed have been found to be acceptable; however, significant technical issues remain to be resolved. These include the following:

- Development of a sound technical strategy for reflecting composite radionuclide source terms, i.e., the inventory of radioactive materials buried at waste sites
- Revision of DOE Order 5820.2A, *Radioactive Waste Management*, covering requirements determined to be necessary as a result of studies performed in accordance with the implementation plan

Overall, after initially misjudging the technical complexity of implementing this recommendation, DOE appears to have successfully changed course and is making progress in implementing Recommendation 94-2. The Board is following the Department's ongoing efforts closely to ensure that implementation of the recommendation remains consistent with the Board's intent.

2.6.2 Hanford High-Level Waste Tank Farms

The Board continues to place high priority on safety problems arising from the storage of high-level radioactive waste in underground storage tanks at the Hanford Site.

Safety issues are associated with continued storage, as well as with ultimate remediation of the waste. The Board has issued several recommendations calling for improved knowledge of the composition of the waste, and for better planning and systems engineering in its retrieval, treatment, and immobilization.

Recommendation 95-2, *Safety Management*, called for the development of an integrated safety management system for DOE facilities. In response, DOE proposed to implement such a system at a number of priority facilities, including the Hanford tank farms. In 1996, in fulfillment of this commitment, DOE upgraded its safety documentation for the tank farms by completing and approving a Basis for Interim Operations, which was the first consolidated safety analysis for the tank farms based on a complete hazard analysis. The DOE contractor also completed the Final Safety Analysis Report by the end of 1996 and submitted it to DOE for approval.

Because of the uncertainty associated with the tank contents and phenomena associated with chemical reactions in the tanks, bounding calculations have determined that several accident types are credible and could result in severe consequences to both the public and workers. In particular, the risk from potential organic nitrate reactions or flammable gas deflagrations in the tanks was calculated to be excessive. DOE has yet to provide sound justification for allowing operations under these conditions. During fiscal years 1997 and 1998, the Board will continue to review DOE's work to resolve this important issue.

2.6.3 Waste Characterization

Recommendation 90-3, *Hanford Future Tank Monitoring*, first identified issues related to characterization of the Hanford wastes, particularly those containing potentially explosive ferrocyanide compounds. That recommendation was superseded by Recommendation 90-7, *Safety at Single-Shell Hanford Waste Tanks*, which called on DOE to assign appropriate urgency to studying, characterizing, and monitoring the wastes to ensure that the potential for an explosive ferrocyanide reaction would be minimized. Recommendation 93-5, *Hanford Waste Tanks Characterization Studies*, urged general acceleration of the waste characterization program, with emphasis placed on those tanks posing the greatest hazards.

In 1996, after some success in accelerating its program of waste sampling and characterization, DOE revised its implementation plan for Recommendation 93-5. The new plan incorporates the remaining commitments of Recommendation 90-7. This plan, accepted by the Board in September, focuses on sampling and characterizing certain high-priority tanks, intended to provide the greatest amount of useful information for resolving safety issues. Additional data on characterization are to be gained from historical records, analysis, and experimentation.

DOE subsequently obtained samples from several ferrocyanide tanks, and performed theoretical analysis and experiments to determine the ability of that waste to sustain a propagating reaction. From these tests, DOE determined conclusively that the ferrocyanide

had degraded to relatively inert compounds and that the risk of explosion was negligible. Therefore, with the Board's concurrence, DOE closed the ferrocyanide safety issue at the end of 1996. The Board recognized this achievement as a significant milestone and considers DOE's performance in resolving the ferrocyanide issue a model to be followed in investigating and ultimately resolving the remaining tank safety issues.

2.6.4 Tank Waste Remediation System

The Tank Waste Remediation System (TWRS) is DOE's conceptualized system for retrieving, treating, immobilizing, and otherwise preparing for the ultimate disposal of the high-level radioactive wastes stored in tanks at the Hanford Site. As currently conceived, the system will require the construction and operation of a number of major new facilities, none of which is yet firm in design. The need for a number of new tanks was identified in early studies of TWRS to facilitate the transfer, stabilization, and treatment of materials from existing tanks, and to add capacity for anticipated new wastes resulting from deactivation and cleanup of formerly used production facilities.

One of these new facilities was the subject of Recommendation 92-4, *Multi-Function Waste Tank Facility at the Hanford Site*. In this recommendation, the Board stressed the need for a systems engineering approach for the entire TWRS program to ensure that the Multi-Function Waste Tank Facility design would be closely integrated into the design of the TWRS as a whole and not be developed as an isolated component. DOE's implementation plan for Recommendation 92-4 did commit to a systems engineering approach for the TWRS. The plan, however, was never brought to fruition. The Multi-Function Waste Tank Facility project was canceled. Instead, the entire TWRS program is being restructured.

Under the new strategy for developing the TWRS, DOE is attempting to attract private industry to finance, build, and operate facilities to treat and process the tank wastes into a form suitable for long-term disposal. Presumably, under such an arrangement, DOE would commit to payment per unit of immobilized product delivered. In addition, the Department envisions Nuclear Regulatory Commission licensing of any such facilities financed, built, and operated by the private sector.

In the first phase of this privatization effort, DOE has let two contracts for pilot-scale facilities that will treat and immobilize the waste from some tanks. The Department has also funded a series of studies and reports to demonstrate the feasibility of the project. These studies are intended to establish the viability of the technical approach by developing process flow sheets and conducting process and product verification tests. During this phase, the contractors are required to deliver program plans describing to DOE how the environment and the health and safety of the public and workers will be protected during system operations.

The Board will continue its safety oversight of this evolving DOE strategy and of the safety of the facilities that result from this arrangement.

3. ADMINISTRATIVE MATTERS

3.1 PERSONNEL RECRUITMENT

As of December 31, 1996, the Board had a staff of 101 full-time employees, including two Site Representatives at the Pantex Plant, near Amarillo, Texas; two Site Representatives at the Hanford Site, in Richland, Washington; two Site Representatives at the Rocky Flats Environmental Technology Site, near Denver, Colorado; and two Site Representatives at the Savannah River Site, near Aiken, South Carolina.

The highly technical mission of the Board requires staff of very high scientific and technical caliber with demonstrated competencies in all major aspects of nuclear safety. The Board's technical staff includes individuals with extensive backgrounds in nuclear, mechanical, electrical, chemical, structural, and metallurgical engineering and in physics. As an indication of the Board's technical talent, 20 percent of the technical staff hold degrees at the Ph.D. level, and an additional 66 percent have masters degrees. Most of the others, all of whom are college graduates, are technical interns who are likely to complete their masters-level programs within the next year. Moreover, almost all technical staff members, except interns, possess practical nuclear experience gained from duty in the U.S. Navy's nuclear propulsion program, the nuclear weapons field, or the civilian reactor industry. Five senior members of the Board staff have law degrees (JD), in addition to degrees in a technical specialty. Both the Board and its staff include individuals experienced in environmental impact assessments and regulatory processes.

Staff expertise is supplemented on occasion by outside experts with special technical knowledge and extensive experience in the areas of plutonium processing, weapons assembly and disassembly, and other nuclear operations. Since the limited staff size precludes the ability to cover all scientific matters by means of in-house specialists, the Board contracts for specialized technical expertise as needed. Drawing on the work of its technical staff and outside experts and utilizing its own considerable specialized knowledge and capabilities, the Board has been able to make technical judgments and to serve collectively as author of its recommendations and related actions.

Through its technical intern program, the Board has continued to recruit and develop a select group of the nation's top engineering graduates. Currently, eight interns are in various phases of a three-year training program encompassing formal graduate school education and on-the-job training. The outstanding academic and on-the-job performance of the five staff members that have already completed the intern program are proof of the effectiveness of these recruitment and selection methods. Board staffing projections include the recruitment of two technical interns in 1997.

3.2 OFFICIAL SITE VISITS BY BOARD MEMBERS AND STAFF

From the establishment of the Board in October 1989 through the end of 1996, the Board, its staff, and its contractor experts have collectively made 1,033 site visits to DOE's defense nuclear facilities. In 1996 alone, 163 site visits were made. These visits focused primarily on selected facilities that both the Board and DOE consider to pose the most pressing concerns in light of DOE's mission. Where appropriate, trip reports on staff visits have been conveyed formally to DOE managers.

During its visits to DOE sites, the Board has reviewed health and safety issues firsthand and gathered information relevant to its recommendations to the Secretary of Energy and their implementation.

3.3 PUBLIC INTERACTION WITH THE BOARD

The Board is sensitive to the need for public involvement in and awareness of defense nuclear safety issues. In its public health and safety reviews, the Board's contacts with the public are primarily through open hearings and access to the Board's public reading room. Since 1990, the Board has held 52 public hearings at sites across the nation and in Washington, D.C. The 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.

To assist the public in requesting information, the Board published a Customer Service Standard in July 1995. This publication catalogs the various public information services offered by the Board. It was mailed to all groups and individuals on the Board's mailing list and placed in a new customer service category on our Internet site.

The Board has found public meetings to be very effective tools for encouraging responsiveness on the part of Department representatives, and for exchanging information with state and local officials, labor leaders, DOE facility workers, public interest groups, and area residents.

During 1996, the Board conducted a public hearing near the Savannah River Site to review the status of DOE's plans to start up and operate the Defense Waste Processing Facility. In addition, three public meetings were held at the Board's Washington, D.C., offices, at which the Board, its technical staff, and outside experts discussed, among other topics, the status of work in DOE's Standards Based Safety Management Program, as well as DOE technical personnel issues. In addition to these public meetings, members of the Board staff have provided information briefings to local officials and public interest groups in the vicinity of the Pantex Plant and the Savannah River, Hanford, and Rocky Flats Environmental Technology Sites.

Notices of such public Board 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 three times in several local newspapers serving the communities near the DOE facility involved, as well as being placed on the Board's Internet site.

During fiscal year 1996, the Board continued to offer more information to the public through its Internet site. This electronic library gives the public an opportunity to view a collection of documents that represent products directly related to the Board's mission. The Board recently added the full text of each of its six previous annual reports to Congress and expanded its database of technical staff reports on trips to DOE defense nuclear facilities. In addition, the Board's Internet site now has an automated search feature that allows readers to locate specific words or phrases in all available documents. Electronic access to information on the Board's health and safety review activities continues to be heavily utilized by the public, DOE, and its contractors.

In January 1997, the Board's Internet site received a "Four Star Best of the Web" Award from NetGuide, Inc., as one of the best sites on the World Wide Web for content, design, and overall rating. The award is given to only those organizations whose Web sites meet stringent criteria for overall excellence.

3.4 NATIONAL PERFORMANCE REVIEW OBJECTIVES

During the past four years, the President has directed that all executive branch agencies conduct an in-depth examination of their individual legislative mandates and operations as an integral part of a fundamental rethinking of what the federal government should do and how it should be done. This program, under the direction of the Vice President, is called the National Performance Review.

The Board believes that as a relatively new agency, not encumbered by years of bureaucratic rules, regulations, and practices, it has already accomplished many of the streamlining objectives of the National Performance Review. At its inception, the Board recognized the importance of carefully structuring an organization that would avoid layering, promote empowerment, and encourage timely action. It has built a strong organization based on the successful implementation of the following initiatives.

3.4.1 Starting Without Encumbrances

When it started its operations in November 1989, the Board did not inherit any staff, organizational structure, or internal regulations governing the conduct of business. Therefore, it was free to create a lean organization tailored to its specialized scientific and technical mission, without the encumbrances often associated with traditional government operations, such as vertical layering, excessive administrative support, and duplication of

function. The lean structure of its technical organization enables the Board to use technical staff members in an optimum way to address each new topic as it arises.

3.4.2 Reducing Regulatory Burden

The Board's policy on regulations is fully consistent with the President's memorandum on streamlining the bureaucracy. To date, the Board has promulgated only those internal regulations necessary to maintain orderly operations—related to the Freedom of Information Act, the Privacy Act, the Government in the Sunshine Act, and Organizational and Consultant Conflicts of Interest. Moreover, in promulgating these regulations, the Board has written the rules in ways that achieve the statutory purposes without burdening the Board or the public with inflexibility, or with overly prescriptive requirements that attempt to substitute excessive paperwork for sound judgment.

3.4.3 Excepted Service and Pay for Performance

The Board successfully argued for, and subsequently received through legislation and administrative delegations, the means to overcome many of the administrative roadblocks that have traditionally frustrated change in government organizations. Most prominent on this list of specific statutory authorities sought by the Board and ultimately granted by the Congress is the excepted service personnel authority.

The pay banding and pay for performance concepts recommended in the National Performance Review have been operational at the Board for more than four years and have received favorable review by the General Accounting Office and the Office of Personnel Management. These concepts have proven to be highly effective in hiring technical talent, holding employees accountable for their performance, and rewarding outstanding performance on the job.

3.4.4 "No Frills" Approach to Operations

From the first day of operation, the Board members have set a standard for having a "no frills" approach to conducting business. Administrative expenses are carefully reviewed for absolute necessity before expenditures are allowed. For example, the Board does not employ chauffeurs and has no government automobiles for local travel of Board members or staff. It carefully enforces the federal travel regulations. These internal policies have been in place since the Board's inception with no adverse impact on operations. Internal directives have been written to give practical and easily understood guidance in the most simplified manner.

3.4.5 Effective Organization Structure

The Board maintains focus on its mission regarding the adequate protection of public and worker health and safety at DOE defense nuclear facilities. Using a matrix form of organization, the Board has gained management flexibility and avoided the creation of layers

of middle management that could dilute its limited staff resources and thereby impede its ability to perform health and safety reviews.

Adopting the philosophy of economies of scale for obtaining needed administrative support services, the Board has negotiated Interagency Agreements with the U.S. Nuclear Regulatory Commission, the Public Health Service, and the General Services Administration to obtain support for accounting, procurement, personnel, and payroll services. Resources that would normally be diverted to these administrative functions remain dedicated to the health and safety mission.

3.4.6 Management Continuity

Under the Board's enabling legislation, the five members are appointed to staggered five-year terms on a full-time basis. Thus, the Board has enjoyed management continuity and has not been subjected to the disruption of frequent changes in leadership experienced by many government agencies. This has permitted the Board to provide precise and consistent direction for the conduct of its technical mission and major policy issues, as well as a degree of constancy and stability for DOE's upgrading efforts in safety management.

3.4.7 Experienced Leadership

Building an organization from its statutory foundation offers a special management challenge requiring individuals with outstanding planning skills, organization skills, and detailed knowledge of a wide range of federal government policies and practices. To meet this challenge, the Board successfully recruited a small senior management staff with demonstrated management experience and proven accomplishments. Using their collective knowledge of government operations, the Board and its senior management staff planned and implemented an organizational structure that maximizes the effectiveness of the scientific and technical resources available and avoids unnecessary layers of management.

3.4.8 Information Technology

To improve communications with DOE field sites and to reduce travel time and expenses, the Board installed video teleconferencing equipment at its headquarters location. The Board has used this 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 technical staff to receive briefings from DOE and its contractors with minimal burden to the DOE site staff. During the first five months of operation, the Board's video teleconferencing facility was used 37 times with 192 participants (some individuals participated in more than one conference). Communications costs for an average session were \$.36 per minute. If the Board had purchased airline tickets for all of the staff members participating in these sessions, the cost would have been about \$100,000.

The Board maintains a high-speed connection to the Internet for all staff members, which allows technical and administrative staff to communicate via electronic mail with other federal and state agencies and members of the public. Staff members use their desktop computers to obtain the latest information on events at defense nuclear sites, to review draft DOE rules and orders, to participate in the exchange of information with professional societies, to perform research on technical subjects, to access notices and legal decisions, and to send draft reports to colleagues for review. In addition, technical staff on travel and site representatives have remote access to the Board's local area network through dial-in communications, and can pick up and deposit files, review electronic mail, and communicate with colleagues at headquarters.

4. PERFORMANCE GOALS

In its fifth annual report, as required by its enabling statute, the Board reviewed its first five years' experience, concluding that (1) external oversight of the defense nuclear complex is desirable on a continuing basis; (2) the Board has functioned effectively in discharging its statutory responsibilities; (3) although some modest increase in the Board's authority might be worthy of consideration, such changes are likely to be of only marginal value in terms of improving the Board's effectiveness; and (4) formal regulation of the nuclear safety aspects of DOE's defense nuclear facilities would not be a desirable course of action for a variety of reasons, not the least of which is its expense as compared with value received.

As an independent agency, the Board has demonstrated that it charts its own course, within the parameters of its enabling statute, and that it will not be steered by the organization it oversees into a transition to some other form, structure, or mission. The Board believes it has been given a clear mandate from Congress to oversee DOE's defense nuclear complex, and that it has complied with that mandate in a thoroughly competent manner. Furthermore, the Board is compelled by law to carry out the provisions of the statute that established it.

Changes in emphasis and focus will inevitably occur in the complex, resulting mainly from the legacy of the former weapons production activities. As numerous facilities are deactivated and decommissioned in the coming decades, the Board expects to oversee their safe disposition. In addition, it plans to continue to follow closely the safe stabilization and disposal of plutonium-bearing residues and other materials. Among the Board's highest priorities will be to help ensure safety in maintenance of the weapons stockpile and safe dismantling of nuclear weapons.

As many DOE activities and programs are brought to a halt, others must be maintained or will start afresh. To maintain the enduring nuclear weapons stockpile, new facilities must be designed, constructed, and brought into operation in the next several years, most specifically for the production of tritium. The Board will follow the work leading to selection of the preferred tritium production technology, and then oversee its design, construction, testing, and operation. As is the case for all new facilities, the Board intends to utilize the extensive technical expertise and background it has acquired during the past seven years to ensure the safety of these operations.

A great deal has been written and said in the past several years on the subject of external regulation of DOE nuclear facilities. The Board discussed this question briefly in its sixth annual report and more extensively in its fifth annual report. For the present, the following observations may be offered.

First, it should be recalled that many aspects of DOE nuclear facilities are already subject to external regulation in some form. The Environmental Protection Agency and its

state counterparts have broad regulatory powers over DOE facilities by virtue of the environmental statutes: the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Clean Air Act; and the Clean Water Act. By Presidential order, DOE must adhere to worker protection standards set forth in the Occupational Safety and Health Act, and has executed a Memorandum of Understanding with the Occupational Safety and Health Administration to study a full transfer of regulatory powers for worker safety. The Nuclear Regulatory Commission has regulatory authority over a number of DOE facilities, including the High-Level Waste Repository at Yucca Mountain.

Second, the Board has seen no analysis demonstrating that formal regulation of DOE defense nuclear facilities (to an extent not already imposed) would result in greater public or worker safety. Arguments have been put forth that the greater cost of formal regulation can be justified by increased public confidence and regulatory stability. In the Board's view, public confidence stems mainly from long-term safety performance, and regulatory stability does not necessarily follow from a formalized regulatory scheme.

Finally, the Board adheres to the view that each step toward more formal regulation of DOE defense nuclear facilities by any federal agency, including the Board, should be justified in terms of both cost and the impact on national security. Proposals put forth to date acknowledge these factors, but then appear to brush them aside without thorough analysis. The Board realizes that this issue involves public policy matters that are broader than the current mission assigned the Board by Congress. However, the Board does have both expertise and experience pertinent to the subject, and stands ready to make itself available to those in the Administration and Congress who may elect to deliberate on this subject.

In this context, then, this section sets forth the Board's performance goals with regard to broad safety issues, evolving technical challenges, long-range goals, near-term objectives, and site-specific objectives.

4.1 BROAD SAFETY ISSUES

During the coming months, extending through and beyond 1997, the Board anticipates that the mission of DOE's weapons complex will continue to undergo transition. The weapons stockpile programs will demand continuing attention, even as the legacies of aging facilities, widespread contamination, and huge inventories of highly toxic and radioactive waste products and residues from half a century of nuclear weapons production must be addressed.

In the face of these challenges, and as DOE continues to realign itself to accommodate mandated downsizing, the role of competent, independent external oversight will become even more demanding. The Board believes firmly that its oversight function is an indispensable element of the overall national effort to cope with the myriad of safety issues at defense nuclear facilities.

To make the most effective use of available resources, the Board has prioritized its oversight activities at specific sites primarily on the basis of (1) potential risk to public and worker health and safety, (2) the effectiveness of DOE's management of those risks, and (3) timeliness in relation to DOE programmatic or operational goals and objectives. If the Board were to learn of an imminent or severe threat to public health and safety at a DOE facility, it would respond and adjust priorities as necessary. In assessing priorities, the Board also considers problems brought to its attention by various outside sources, including members and staff of the Congress, the General Accounting Office, workers and their union representatives, and the public. It should be noted that most of the highest-priority nuclear safety issues involve more than one defense nuclear facility or are complex-wide in scope.

Within this broad context, the Board plans to emphasize the same safety issues it has identified repeatedly in the past, such as the need to:

- Oversee the continuing dismantlement and storage of weapons and weapons components—to help ensure protection of the health and safety of the public and the workers involved, and of the environment.
- Evaluate proposed upgrades to facilities and processes vital to the stockpile stewardship and management programs—to ensure their design adequacy and their safe operation.
- Closely monitor DOE's upgrading of its technical capabilities and expertise and those of its contractors—to verify the effectiveness of DOE's program for improving staff qualifications while it seeks to meet demands placed on a dwindling staff.
- Ensure that DOE expedites the processing, packaging, and safe long-term storage of plutonium-bearing materials—to reduce the risk of unwarranted exposure to these hazards.
- Review in detail authorization bases prepared by DOE for priority facilities and activities—to verify conformance with established principles, including recent guidance prepared by the Board and its staff.
- Monitor the integration of safety management of both defense nuclear research and development activities and weapon assembly, disassembly, and testing operations—to ensure that both can be accomplished effectively and safely.
- Continue to pay close attention to DOE's program for resolving safety issues associated with existing inventories of corroding spent fuel in storage pools at several facilities and with byproduct material from historical defense enrichment operations—to assist DOE in gaining control of these potential and actual sources of significant contamination and radiological exposure.

- Press for safe treatment and disposal of nuclear waste that remains as residues in buried tanks at former plutonium production sites—to eliminate these sources of long-term radiological hazard.
- Encourage DOE to continue to improve its radiation protection program—to reduce the risk of unnecessary worker exposure, as well as potential public exposure.
- Monitor closely DOE's planning for work in hazardous and radiological environments, criteria for release of materials and facilities after cleanup, and development and evaluation of indicators of radiological protection performance applicable to unique cleanup situations—to ensure adherence to the principles of the as-low-as-reasonably-achievable concept.
- Evaluate DOE's ongoing expedited revision of its program for development and promulgation of requirements, including orders, rules, standards, guides, and contract provisions, as well as review DOE's programs for verification of adherence to those requirements—to ensure that DOE appropriately integrates these processes.
- Insist that DOE adopt sound systems engineering practices in all its safety-related projects and programs—to foster the optimum overall management of the DOE safety program.

4.2 EVOLVING TECHNICAL CHALLENGES

Technical issues at DOE continue to evolve. The combination of well-recognized and long-standing threats to public health and safety and potentially hazardous new activities presents unique and potentially serious challenges. These include, for example, the need to:

- Operate facilities for short periods to remove and stabilize radioactive or hazardous materials held up in processing lines and vessels.
- Establish improved storage conditions to minimize corrosion of spent nuclear fuel stored in basins that were not designed for long-term use.
- Gain control of the existing inventories of chemical and radioactive wastes, which continue to grow and are bound to become even larger when decontamination and decommissioning get under way in earnest.
- Surmount technical problems associated with existing high-level radioactive waste storage tanks.

- Ensure the safe startup and operation of high-level radioactive waste processing facilities.
- Ensure that the dismantlement of large numbers of warheads each year is conducted safely.
- Design, construct, and operate facilities for storing nuclear materials from dismantled nuclear weapons.
- Consolidate weapons stockpile stewardship and management functions at a reduced number of sites, including upgraded facilities that were previously used predominantly for research and development.
- Determine possible roles of existing research and development facilities for limited production missions, and institute as necessary the significant modifications to traditional laboratory operating practices required to carry out those roles safely.
- Process and replenish tritium in nuclear weapons retained in service.

The Board is concerned that safety issues associated with these technical challenges, and others not yet identified, may be at least as large in number and just as severe as those encountered during production operations.

4.3 LONG-RANGE GOALS

Within the next five fiscal years, the Board, through its oversight/recommendation process, will strive to effect within DOE the following improvements to nuclear safety elements:

- Complete the reconciliation, integration, and upgrading of directives that form the reference standards base for safety management.
- Firmly institutionalize DOE's program for standards-based safety management of all its defense nuclear facilities.
- Complete the development and implementation of integrated safety management programs for a prioritized group of ten operational facilities.
- Complete the development and implementation of integrated safety management programs for at least three shut-down facilities requiring substantial decontamination as a requisite for safe and cost-effective surveillance and maintenance while awaiting non-time-critical environmental restoration under

provisions of CERCLA or RCRA (administered by the Environmental Protection Agency and the states).

- Across the complex, significantly upgrade hazardous work planning processes down to the task level, making safety planning an integral part of the process.
- Recruit and retain a senior technical core of DOE personnel with demonstrated capabilities to manage contractors that are delegated clearly defined safety responsibilities.
- Effect a substantial strengthening of DOE's safety management program so that an orderly transition can be made in which less reliance is placed on the Board and more on DOE to force needed safety actions.
- Place priority on efforts to ensure safe, reliable operation in those facilities necessary for DOE to meet the production and dismantlement goals of the national defense program.

4.4 NEAR-TERM OBJECTIVES

During fiscal year 1998, as in fiscal year 1997, the Board intends to continue to place high priority on oversight objectives for which successful implementation by DOE and its contractors should result in significant health and safety improvements. Examples are the following:

- Ensuring that DOE expedites the processing, packaging, and safe long-term storage of plutonium-bearing materials to reduce the risk of unwarranted exposures to these hazards.
- Overseeing the development and implementation of integrated safety management programs for ten priority facilities.
- Encouraging safety planning as an integral part of enhanced work planning.
- Overseeing the continuation of dismantlement of weapons and storage of weapons components to help ensure protection of the health and safety of the public and workers.
- Evaluating DOE's enhanced weapon surveillance processes to anticipate and resolve potential safety issues resulting from stockpile aging.
- Evaluating proposed upgrades to existing facilities and processes, as well as the design and construction of new alternative weapon testing facilities vital to the

stockpile stewardship and management programs, to ensure design adequacy and safe operation.

- Monitoring closely the upgrading of the technical capabilities and expertise of DOE and its contractors to verify the effectiveness of DOE's program for improving staff qualifications as it seeks to meet demands placed on a dwindling staff.
- Reviewing authorization bases for priority facilities and activities to verify conformance with established health and safety principles, including recent guidance prepared by the Board.
- Reviewing designs for new tritium production facilities to ensure their adequacy from the point of view of worker and public safety and protection of the environment.
- Insisting that the safety functions and responsibilities of all DOE organizations involved be defined and understood.
- Monitoring the integration of safety management of both defense nuclear research and development activities and weapon assembly, disassembly, and testing operations to ensure that they can be accomplished effectively and safely.
- Continuing to pay close attention to DOE's ongoing program for resolving safety issues associated with existing inventories of corroding spent fuel in storage pools at several facilities and with byproduct material from defense enrichment operations, to assist DOE in gaining control of these potential and actual sources of significant contamination and radiological exposure.
- Encouraging DOE to continue to improve its radiological protection program to reduce the risk of unnecessary worker exposure, as well as potential public exposure.
- Maintaining close scrutiny of DOE's programs for safe handling and disposition of waste material to help DOE improve its waste management programs.
- Evaluating DOE's ongoing expedited revision of its program for development and promulgation of requirements, including orders, rules, standards, guides, and contract provisions, as well as reviewing DOE's programs for verification of adherence to those requirements, to ensure that DOE appropriately integrates these processes.
- Evaluating DOE systems engineering practices in all its safety-related projects and programs, to foster DOE's optimum management of its safety program.

4.5 SITE-SPECIFIC OBJECTIVES

The Board has identified specific defense nuclear facilities and activities having high priority for its oversight attention. Factors influencing the selection of these facilities for priority attention include the severity of the hazard, operational intensity, and the expected lifetime of the operation involved. Table 1 presents specific Board oversight actions planned for each of these facilities during fiscal years 1997 and 1998.

Table 1. Priority Facilities and Activities

PANTEX FACILITIES		
Facility	Status	Hazards
Plant-wide Activities	Operational	High-Moderate
<p>FY 1997:</p> <ul style="list-style-type: none"> • Oversee the safety of the continuing dismantlement of weapons and weapons components • Monitor the safety of DOE's program for surveillance of nuclear weapons • Assess the adequacy of safety measures applied to the manufacture of explosive charges for nuclear weapons • Observe DOE's conduct of specific nuclear explosive safety studies • Assess the adequacy of DOE's implementation of Recommendation 92-6, involving improvements in the readiness review process for weapon operations • Oversee the implementation of integrated safety management systems under Recommendation 95-2 • Review the Essential Standards Program 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Oversee the safety of the continuing dismantlement and storage of weapons and weapons components • Monitor the safety of DOE's program for surveillance of nuclear weapons • Evaluate the interfaces between high-explosives safety and nuclear explosive operations • Observe DOE's conduct of specific nuclear explosive safety studies • Oversee the implementation of integrated safety management systems under Recommendation 95-2 • Review the Essential Standards Program 		
Building 12-116, SNM Staging Facility (New Nuclear Facility)	New Facility - Startup in FY 1998	Moderate (at present): Plutonium, Uranium, Tritium
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review the safety aspects of design and construction • Follow the development of the authorization basis and integrated safety management system • Monitor preparations for startup 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Assess the adequacy of the final authorization basis and integrated safety management system • Review the safety aspects of design and construction • Observe preparations for startup and the Operational Readiness Review process 		

Data as of: 01/22/97

Table 1. Priority Facilities and Activities (Continued)

OAK RIDGE FACILITIES		
Facility	Status	Hazards
Plant-wide, Y-12 Plant	Operational	Moderate
<p>FY 1997:</p> <ul style="list-style-type: none"> • Closely monitor the implementation of contractor and DOE corrective actions identified by assessments in the areas of criticality safety, conduct of operations, and training and qualification as specified in the implementation plan for Recommendation 94- 4 • Monitor the implementation of integrated safety management systems under Recommendation 95-2 for enriched uranium operations; component assembly, disassembly, and evaluation; and nuclear material storage • Review the Essential Standards Program • Monitor safety performance under stockpile maintenance 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Ensure effective completion of corrective actions associated with Recommendation 94-4 • Review the implementation of integrated safety management systems • Review the Essential Standards Program • Monitor safety performance under stockpile maintenance 		
Y-12: Highly Enriched Uranium Processing	Operational	Moderate: Highly Enriched Uranium; Hazardous, Toxic, and Radioactive Materials
<p>FY 1997:</p> <ul style="list-style-type: none"> • Assess the Integrated Safety Management Plan • Monitor the safety of restart activities for the enriched uranium operations in Building 9212 to support national security tasking (W87 Life Extension Program) • Review DOE's plan to process the excess in-process material in Buildings 9212 and 9206 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Monitor the Operational Readiness Review for enriched uranium operations in Building 9212 and initial operations • Monitor progress in processing the in-process material in Buildings 9212 and 9206 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
Y-12: Component Assembly, Disassembly, and Evaluation	Operational	Moderate: Highly Enriched Uranium; Hazardous, Toxic, and Radioactive Materials
<p>FY 1997:</p> <ul style="list-style-type: none"> • Monitor the potential safety impacts of increased operational tempo in nuclear weapon secondary dismantlement operations, and review readiness for dismantlement operations on newly retired weapons systems • Review the safety aspects of preparations for the weapon life extension program • Monitor the implementation of DOE's Enhanced Surveillance Program for potential safety implications 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Review the authorization bases for Buildings 9402-2/2E and integrated safety management systems • Continue to review the safety aspects of readiness for dismantlement operations on newly retired systems • Review the safety aspects of readiness for additional weapon life extension program activities • Monitor the Operational Readiness Review for quality evaluation activities in Building 9204-2E and initial operations 		
Y-12 and ORNL: Material Storage	Operational	Moderate: Highly Enriched Uranium; Uranium-233; Hazardous, Toxic, and Radioactive Materials
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review the safety of Building 3019 as the uranium-233 national repository • Oversee the development of a uranium storage standard for in-process material, canned subassemblies, and uranium-233 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Continue Board oversight of the above activities, as appropriate 		
K-25 Remediation of Highly Enriched Uranium and Storage of Depleted Uranium Tailings	Transition	Moderate: Highly Enriched Uranium, Depleted Uranium, Hydrogen Fluoride
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review progress on the removal of highly enriched uranium held up in piping and systems in gaseous diffusion plant equipment • Review the establishment of the depleted uranium cylinder coating renewal program under Recommendation 95-1 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Review the construction and loading of the depleted uranium cylinder storage yard 		

Table 1. Priority Facilities and Activities (Continued)

LOS ALAMOS NATIONAL LABORATORY NUCLEAR FACILITIES		
Facility	Status	Hazards
Site-wide	Operational	High-Moderate
FY 1997: <ul style="list-style-type: none"> • Review integrated safety management systems and their initial implementation at the site level • Review the adequacy of seismic design criteria • Review the Essential Standards Program 		
FY 1998: <ul style="list-style-type: none"> • Review the implementation of integrated safety management systems • Review the Essential Standards Program 		
TA-55, Plutonium Facility, LANL's main facility for R&D and processing of plutonium	Operational	High: Plutonium, Chemical Hazards, Nuclear Criticality
FY 1997: <ul style="list-style-type: none"> • Review integrated safety management systems, including the adequacy of hazard assessments for research, development, and demonstration projects • Review the Advanced Recovery and Integrated Extraction System project for recovering plutonium from pits • Review the safety aspects of the Conceptual Design Report for the Capability Maintenance and Improvement Project to prepare TA-55 for future pit production • Continue to review the Nuclear Materials Storage Facility; review the updated preliminary hazards assessment; begin to review the preliminary design 		
FY 1998: <ul style="list-style-type: none"> • Continue to review integrated safety management systems • Continue to review the Capability Maintenance Improvement Project and related activities for future pit production • Continue to review the Nuclear Materials Storage Facility (review the Preliminary Safety Analysis Report and the Preliminary Design) 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
TA-3, Chemistry and Metallurgy Research Building, an R&D Facility	Operational	Moderate: Plutonium, Uranium, Chemical Hazards
FY 1997: <ul style="list-style-type: none"> • Review integrated safety management systems, including the adequacy of hazard assessments for research, development, and demonstration projects • Review the safety aspects of the Detailed Design Report for Chemistry and Metallurgy Research Building upgrades 		
FY 1998: <ul style="list-style-type: none"> • Review integrated safety management systems, including the adequacy of hazard assessments for research, development, and demonstration projects • Review the safety aspects of the Final Design Report for Chemistry and Metallurgy Research Building upgrades • Review preparations for activities related to pit production to ensure safety 		
TA-18, Los Alamos Critical Experiments Facility	Operational	Moderate: Nuclear Criticality
FY 1997: <ul style="list-style-type: none"> • Continue to review the adequacy of implementation of safety measures for criticality controls under Recommendation 93-2 		
FY 1998: <ul style="list-style-type: none"> • Continue to review the adequacy of implementation of safety measures for criticality controls under Recommendation 93-2 		
TA-16, Weapons Engineering Tritium Facility	Operational	Moderate: Tritium
FY 1997: <ul style="list-style-type: none"> • Review proposed facility modifications 		
FY 1998: <ul style="list-style-type: none"> • Review integrated safety management systems, including the adequacy of hazard assessments for research, development, and demonstration projects 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
TA-15, Dual Axis Radiographic Hydrotest Facility	Partially Constructed	High: Radiation Generating Device, Explosions, Depleted Uranium, Chemical Hazards
FY 1997: <ul style="list-style-type: none"> ● Review the facility design and provisions for the safety management program 		
FY 1998: <ul style="list-style-type: none"> ● Review readiness for operation 		
TA-53, Los Alamos Nuclear Scattering Center	Operational	Moderate: Tritium, High-Energy Accelerator Beam
FY 1997: <ul style="list-style-type: none"> ● Review the safety of activities related to the new defense nuclear mission 		
FY 1998: <ul style="list-style-type: none"> ● Review integrated safety management systems, including the adequacy of hazard assessments for research, development, and demonstration projects 		
Accelerator Production of Tritium, To Be Designed by Los Alamos National Laboratory and Constructed at the Savannah River Site	Pre-design	Moderate: Tritium, High-Energy Accelerator Beam
FY 1997: <ul style="list-style-type: none"> ● Review the safety aspects of the Los Alamos National Laboratory design 		
FY 1998: <ul style="list-style-type: none"> ● Continue the design review 		

Table 1. Priority Facilities and Activities (Continued)

SAVANNAH RIVER SITE FACILITIES		
Facility	Status	Hazards
Site-wide Activities	Operational	High-Moderate
<p>FY 1997 and FY 1998:</p> <ul style="list-style-type: none"> • Monitor ongoing site-wide implementation of provisions for stabilization and disposition of special nuclear materials under Recommendation 94-1 • Monitor ongoing site-wide implementation of provisions for handling low-level waste under Recommendation 94-2 • Monitor ongoing site-wide implementation of provisions for standards-based safety management under Recommendation 95-2 • Negotiate a memorandum of understanding involving the Board, the state, and the Environmental Protection Agency • Continue to review both DOE and contractor implementation of integrated safety management systems, starting with review of hazard analyses, followed by reviews of Safety Analysis Reports and Technical Safety Requirements (particularly for the americium-cerium vitrification activity and H-Canyon operations) • Monitor safety aspects of the processing of plutonium metal in storage and of irradiated fuel and target assemblies in storage basins • Review the content and implementation of site-wide Standards/Requirements Identification Documents 		
Defense Waste Processing Facility/In-Tank Precipitation Facility, High-Level Waste Tanks	Operational	High: Fission Products
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review DOE's development of the implementation plan for a program to gain understanding of the mechanisms involved in benzene production under Recommendation 96-1 • Closely monitor corrective actions defined by the Recommendation 96-1 implementation plan • Continue to focus on efforts to understand benzene generation and release mechanisms in the In-Tank Precipitation process • Assess the safety of ongoing startup activities and initial operation involving precipitate processing in the Defense Waste Processing Facility, assuming satisfactory resolution of benzene issues • Monitor and assess ongoing high-level waste tank farm operations • Evaluate safety issues associated with startup of the Consolidated Incinerator Facility • Assess and observe activities for closure of high-level waste tanks 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Continue to monitor Defense Waste Processing Facility operations, particularly during efforts to increase facility capacity (from 200 to 300 canisters/year) 		

Table I. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
F-Canyon/FB-Line/FA-Line H-Canyon/HB-Line/HA-Line	Operational	High: Plutonium, Uranium, Transuranics, High-level Waste
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Review the transfer of plutonium-239 solutions from H-Canyon to F-Canyon, and the processing of these solutions to oxide in the FB-Line ● Monitor processing of plutonium-242 solution to oxide in the HB-Line ● Review the design, safety analysis, and construction of the americium-curium vitrification project ● Monitor the processing of irradiated Mark-31 targets to metal in F-Canyon and FB-Line ● Evaluate the operational readiness of H-Canyon for startup to process highly enriched uranium spent fuel ● Review the design, safety analysis, and construction of modifications required to process highly enriched uranium spent fuel in F-Area ● Monitor FB-Line modifications and startup for new characterization, digital radiography, repackaging, and bagless capabilities for plutonium materials ● Monitor FB-Line operations for processing of plutonium scrap metal 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Review the Integrated Safety Management Plan ● Evaluate the operational readiness and monitor operations of americium-curium vitrification 		
Tritium Facilities	Operational	High: Tritium
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Review the safety of activities associated with strategic stockpile loadouts ● Assess the adequacy of safety measures involved in tritium storage activities ● Monitor DOE's decision-making process regarding potential methods for new tritium production to ensure that suitable safety considerations are taken into account ● Review safety aspects of the conceptual and preliminary designs for the selected new tritium production technology ● Review the conceptual design and Preliminary Safety Analysis Report for the new tritium extraction facility 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Continue to monitor the safety of strategic stockpile loadouts and tritium storage ● Review the safety of the design and construction of an expanded capacity for unloaded reservoirs ● Oversee the safety of DOE's expansion of tritium stockpile surveillance activities as these new activities are developed, approved, and implemented 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
Receiving Basin for Off-site Fuel, L-Basin, K-Basin, and P-Basin	Operational	Moderate: Plutonium, Uranium, Fission Products
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Monitor the safety of the removal of defense-related spent fuel from the basins for processing ● Evaluate the safety/hazards of Mark 16/22 spent fuel transfers to H-Canyon ● Monitor the safety of the removal of consolidated sludge from L-Basin ● Monitor the vacuum consolidation of sludge in K-Basin ● Review the DOE-approved Safety Analysis Report for the Receiving Basin for Off-site Fuel 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Monitor the safety of the removal of defense-related spent fuel from the basins for processing ● Review the safety of the continued transfer of Mark 16/22 spent fuel to H-Canyon ● Review the Integrated Safety Management Plan for transition to deactivation (except the Receiving Basin for Off-site Fuel) ● Monitor the safety of the removal of consolidated sludge from K-Basin 		
K-Reactor	Cold Standby	Moderate: Mixed Fission Products, Activation Products
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Review DOE's determination of hazards and their potential impact on long-term surveillance and maintenance ● Evaluate plans for transition from cold standby to cold shutdown for potential impact on deactivation ● Evaluate the Integrated Safety Management Plan for facility transition to deactivation 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Evaluate the Integrated Safety Management Plan for facility transition to surveillance and maintenance status ● Monitor the implementation of the surveillance and maintenance program 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
Actinide Packaging and Storage Facility	Operational	Moderate: Special Nuclear Materials
FY 1997: <ul style="list-style-type: none"> • Review the design and safety analysis for the new Actinide Packaging and Storage Facility 		
FY 1998: <ul style="list-style-type: none"> • Review the safety aspects of construction of the new Actinide Packaging and Storage Facility. 		

Table 1. Priority Facilities and Activities (Continued)

HANFORD FACILITIES		
Facility	Status	Hazards
High-Level Waste Tank Farms	Operational	High: Fission Products, Actinides
FY 1997: <ul style="list-style-type: none"> • Review intermediate and final elements of the upgraded authorization basis • Assess the implementation of the integrated safety management system • Oversee the ongoing waste characterization program • Monitor the ongoing implementation of systems engineering 		
FY 1998: <ul style="list-style-type: none"> • Continue to pursue DOE's implementation of the integrated safety management system • Continue to monitor systems engineering practices • Continue to assess the waste characterization program and resulting disclosures regarding potential safety issues 		
Plutonium Finishing Plant	Operational	High: Plutonium
FY 1997: <ul style="list-style-type: none"> • Review ongoing aspects of the implementation of provisions for stabilization and disposition of special nuclear materials under Recommendation 94-1 • Closely monitor plans for treatment of plutonium residues • Oversee preparations for stabilization of plutonium solutions 		
FY 1998: <ul style="list-style-type: none"> • Closely scrutinize processing of plutonium residues and solutions 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
K-Reactor Area Fuel Storage Basins	Operational	High: Spent Nuclear Fuel, Sludge
<p>FY 1997:</p> <ul style="list-style-type: none"> • Oversee preparations for the transfer of deteriorating spent fuel, stabilization of fuel rods, and cleanup of the basins • Review the adequacy of safety analyses and designs for the new Fuel Retrieval System in the K-Basins, the Canister Storage Building, and the Cold Vacuum Drying Facility • Monitor the construction of the Fuel Retrieval System, the Canister Storage Building, and the Cold Vacuum Drying Facility • Review the results of spent fuel and sludge characterization testing for support of fuel conditioning 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Continue oversight of fuel transfer, stabilization, and cleanup activities • Review authorization bases and authorization agreements for the Canister Storage Building and the Cold Vacuum Drying Facility • Monitor the completion of construction and startup of the Fuel Retrieval System, the Canister Storage Building, and the Cold Vacuum Drying Facility • Monitor the Operational Readiness Reviews for the Fuel Retrieval System, the Canister Storage Building, and the Cold Vacuum Drying Facility 		
PUREX/Redox/233S/B-Plant	Shutdown	High: Plutonium, Mixed Fission Products, Uranium
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review authorization bases and safety management planning • Assess the adequacy of ventilation systems • Review the design and integrity of gloveboxes and building roof • Review the adequacy of the design and operation of bridge cranes • Review preparations for facility deactivation • Evaluate readiness for transition to surveillance and maintenance status 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Monitor the implementation of facility deactivation • Monitor surveillance and maintenance activities 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
Waste Encapsulation and Storage Facility	Operational	Moderate: Cesium and Strontium
FY 1997: <ul style="list-style-type: none"> ● Continue to review indicators of the long-term integrity of cesium and strontium capsules ● Assess the integrity of the storage pool ● Review the capability to detect and handle a leaking container ● Initiate a review of the facility authorization basis 		
FY 1998: <ul style="list-style-type: none"> ● Complete the review of the facility authorization basis ● Continue monitoring of ongoing day-to-day operations 		

Table 1. Priority Facilities and Activities (Continued)

ROCKY FLATS FACILITIES		
Facility	Status	Hazards
Solution Processing and Special Nuclear Material Storage, Building 771	Operating	High: Plutonium Solution, Special Nuclear Material, and Waste
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Assess safety management plans for deinventory activities ● Assess the implementation of the upgraded authorization bases ● Assess the adequacy of the upgraded authorization bases and the Integrated Safety Management Plan ● Review and assess the safety aspects of the plan for oxalate precipitation processing ● Evaluate the readiness of equipment, personnel, and procedures for stabilization and packaging 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Review and assess the safety aspects of the plan for oxalate precipitation processing, as appropriate ● Evaluate the readiness of equipment, personnel, and procedures for processing, as appropriate ● Observe DOE and contractor readiness assessments for processing, as appropriate ● Evaluate the Integrated Safety Management Plan for deactivation 		
Solution Processing and Special Nuclear Material Consolidated Storage, Building 371	Operating	High: Plutonium Solution, Special Nuclear Material, and Waste
<p>FY 1997:</p> <ul style="list-style-type: none"> ● Assess the adequacy of the upgraded authorization bases and the Integrated Safety Management Plan ● Assess the implementation of the upgraded authorization bases ● Review plans for and assess the adequacy and implementation of safety upgrades per the Recommendation 94-3 Integrated Program Plan ● Assess the adequacy of the process selected for processing combustible residues ● Review and evaluate the adequacy of the design of the interim storage vault 		
<p>FY 1998:</p> <ul style="list-style-type: none"> ● Evaluate the readiness of equipment, personnel, and procedures for processing of combustible residues ● Review and evaluate the adequacy of the interim storage vault, as appropriate ● Assess the implementation of the upgraded authorization basis 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
Residue Processing and Special Nuclear Material Storage, Building 776, Building 779, Building 707	Shutdown	High: Plutonium Solution, Special Nuclear Material, and Waste
<p>FY 1997:</p> <ul style="list-style-type: none"> • Assess safety management plans for deinventory of Building 776, and deactivation and decommissioning of Building 779 • Independently assess the adequacy of the process selected for processing of residues • Evaluate the readiness of equipment, personnel, and procedures for processing of residues in Building 707 • Observe DOE and contractor readiness assessments for processing of residues 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Review and assess the deactivation and decommissioning of Buildings 779 and 776 • Independently assess the adequacy of the process selected for processing of residues • Evaluate the readiness of equipment, personnel, and procedures for processing of residues in Building 707 • Observe DOE and contractor readiness assessments for processing of residues 		
Highly Enriched Uranyl Nitrate, Building 886	Shutdown	Moderate: Highly Enriched Uranium Solution, Special Nuclear Material, and Waste
<p>FY 1997:</p> <ul style="list-style-type: none"> • Review the safety management plans for deactivation and decommissioning of Building 886 		
<p>FY 1998:</p> <ul style="list-style-type: none"> • Continue to review the safety aspects of the deactivation and decommissioning of Building 886 		

Table 1. Priority Facilities and Activities (Continued)

IDAHO NATIONAL ENGINEERING LABORATORY FACILITIES		
Facility	Status	Hazards
Advanced Test Reactor	Operational	High: Fission Products, Uranium-235
FY 1997: <ul style="list-style-type: none"> • Review the safety aspects of facility upgrades • Monitor the experiment testing schedule 		
FY 1998: <ul style="list-style-type: none"> • Review facility upgrades • Monitor the experiment testing schedule 		
CPP-603 Underwater Fuel Storage	Operational	Moderate: Fission Products, Uranium, Plutonium
FY 1997: <ul style="list-style-type: none"> • Oversee fuel movements • Monitor preparations for final disposition of the facility 		
FY 1998: <ul style="list-style-type: none"> • Monitor final disposition of the facility 		
CPP-603 Irradiated Fuel Dry Storage Facility	Operational	Moderate: Fission Products, Uranium, Plutonium
FY 1997: <ul style="list-style-type: none"> • Review planned seismic upgrades • Oversee the safety aspects of operation of the canning (drying) facility 		
FY 1998: <ul style="list-style-type: none"> • Continue to monitor facility operation 		

Table 1. Priority Facilities and Activities (Continued)

Facility	Status	Hazards
CPP-666 Irradiated Fuel Dry Storage Facility	Operational	Moderate: Fission Products, Uranium, Plutonium
FY 1997: <ul style="list-style-type: none"> ● Assess the adequacy of the structural analysis of the basins ● Review the safety aspects of the new fuel rack design ● Oversee the safety of the rerecking of fuel 		
FY 1998: <ul style="list-style-type: none"> ● Continue oversight of the safety of fuel movements 		
New Waste Calciner Facility	Operational	Moderate: Fission Products, Uranium, Plutonium
FY 1997: <ul style="list-style-type: none"> ● Oversee preparations for startup ● Review the authorization basis ● Monitor the Operational Readiness Review and the safety of initial operations 		
FY 1998: <ul style="list-style-type: none"> ● Continue to monitor the safety of operations 		

Table 1. Priority Facilities and Activities (Continued)

LIVERMORE FACILITY		
Facility	Status	Hazards
Building 332, Plutonium/Uranium Metallurgy and Chemistry Facility	Operational	Moderate: Plutonium, Uranium
FY 1997: <ul style="list-style-type: none"> • Review the authorization basis and the Integrated Safety Management Plan • Review the seismic design of the building • Continue to monitor criticality safety • Review the safety aspects of the heating, ventilation, and air conditioning system • Monitor the implementation of Recommendation 94-1 		
FY 1998: <ul style="list-style-type: none"> • Continue to monitor the safety of building operations 		
Building 251, Actinide Chemistry Facility	Operational	Moderate: Plutonium, Uranium
FY 1997: <ul style="list-style-type: none"> • Review the authorization basis and the Integrated Safety Management Plan • Monitor the safety of building operations 		
FY 1998: <ul style="list-style-type: none"> • Continue to monitor the safety of building operations 		

Table 1. Priority Facilities and Activities (Continued)

NEVADA TEST SITE FACILITIES		
Facility	Status	Hazards
LYNER Experimental Activities	Operational	High: Plutonium, High Explosives
FY 1997: <ul style="list-style-type: none"> • Review the authorization basis and the Integrated Safety Management Plan • Monitor the safety of the initial subcritical experiments 		
FY 1998: <ul style="list-style-type: none"> • Monitor the safety of continuing subcritical experiments 		
Device Assembly Facility	Approaching Startup	High: Plutonium/Uranium, High Explosives
FY 1997: <ul style="list-style-type: none"> • Assess the adequacy of closure of construction issues • Review the authorization basis and the Integrated Safety Management Plan • Review preparations for the Operational Readiness Review process • Monitor the safety of the transition of operations from Area 27 to the Device Assembly Facility 		

SANDIA NATIONAL LABORATORIES FACILITY

Facility

Status

Hazards

**Technical Area V Reactor
Facilities**

Operational

**Moderate:
Reactors Fueled by
Highly Enriched Uranium**

FY 1997:

- Review integrated safety management systems for defense research and development activities developed under Recommendation 95-2
- Review corrective actions to the radiological protection program in response to recent incidents

FY 1998:

- Review the safety of reactor operations in Technical Area V

**APPENDIX A. *FEDERAL REGISTER* NOTICE FOR
RECOMMENDATION 96-1**

FOR FURTHER INFORMATION CONTACT:
Kenneth M. Pusateri or Andrew L.
Thibadeau at the address above or
telephone (202) 208-6400.

Dated: August 19, 1996.

John T. Conway,
Chairman.

August 14, 1996.

The Defense Nuclear Facilities Safety Board (Board) has devoted substantial attention to the planned use of the In-Tank Precipitation (ITP) System at the Savannah River Site, because of its importance to removal of high-level radioactive waste from storage tanks at that Site, and because certain unique hazards are associated with the ITP process.

The hazards are a consequence of the volatile and flammable organic compound benzene that is released during the process in amounts that must not exceed safe limits. The benzene is generated through decomposition of tetraphenylborate (TPB) compounds. These compounds are added in the process with the objective to precipitate and remove radioactive cesium from solution in the waste water destined for the saltstone process. The concentrated slurry containing the precipitated cesium constitutes a much smaller volume than the original waste, and its feed to the vitrification process leads to production of a correspondingly smaller amount of glass ultimately to be disposed of in a repository.

The proposed treatment process calls for addition of a quantity of TPB in excess of that theoretically required to precipitate the cesium as cesium TPB. That excess is required partly because the significant amount of potassium present is also precipitated as potassium TPB, and partly because an excess of TPB in solution ensures more effective scrubbing of the radioactive cesium through precipitation. However, the benefit of effective scrubbing is accompanied by the generation of the benzene, which presents hazards of a different sort, and which also requires safety controls.

Westinghouse Savannah River Company is the Department of Energy contractor in charge of ITP. The Westinghouse staff at the Savannah River Site believed until recently that the principal cause of decomposition of TPB and generation of benzene is exposure of the TPB to the high level of radiation in the waste. That belief was based on results of full-scale tests conducted in 1983 that may have been misinterpreted, and on a decade of subsequent bench-scale tests using non-radioactive stimulants (almost

exclusively) rather than actual waste. The first large-scale operations with actual waste since 1983 were conducted recently in Tank 48, and they showed that the generation and release of benzene did not follow predictions. The generation of benzene in the waste under treatment in Tank 48 was unexpectedly rapid. A surprisingly large amount of the benzene remained captured in the waste, and that benzene was released through action of mixing pumps in the tank.

The current view of the contractor staff is that benzene is produced principally through catalytic decomposition of TPB ions in solution. They believe the catalysts are potentially both soluble and insoluble species, one of which is soluble copper known to be present in the waste. They also believe that the cesium TPB precipitate and the potassium TPB precipitate are relatively immune to catalytic decomposition. The contractor proposes to conduct two Process Verification Tests (PVT), PVT-1 and PVT-2, to further establish the validity of these views and to demonstrate the accuracy of the model it has developed to predict the rate at which the captured benzene is released from solution. PVT-1 would be performed on the homogenized nuclear waste not in Tank 48, which has already been treated with TPB that subsequently has partly decomposed with the result that some cesium has returned to solution. Additional TPB would be added to this material to reprecipitate that cesium. The amount of TPB to be added would be strictly limited to a small amount as needed to reduce the concentration of cesium remaining in solution to a low radiation level acceptable for processing as low level waste in the saltstone process, and a large part of that solution would be sent to saltstone. The subsequent proposed experiment, PVT-2, will involve adding to the slurry remaining in Tank 48 a large amount of additional untreated waste and a substantial quantity of TPB as needed to precipitate the cesium in this new waste.

The Board has been informed that the primary safety precaution for the proposed cesium removal activities is to maintain an inert atmosphere in the headspace of Tank 48. This is to be done through establishing a sufficient flow of nitrogen to the tank. Two nitrogen feed systems are available, a normal system and a supplemental emergency system. The nitrogen systems are present to keep the concentration of oxygen below the level that would support combustion of the benzene. Westinghouse staff members have

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

(Recommendation 96-1)

In-Tank Precipitation System at the Savannah River Site

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 concerning the In-Tank Precipitation System at the Savannah River Site. The Board requests public comments on this recommendation.

DATES: Comments, data, views, or arguments concerning this recommendation are due on September 23, 1996.

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.

pointed out that these redundant inerting systems provided a sufficient safety factor for control of oxygen concentration in the headspace. They have further stated that the rate of buildup of oxygen concentration from air ingress into the tank headspace, if both inerting systems are simultaneously inoperable, would be slow enough to allow reestablishment of nitrogen flow before the bulk vapor in Tank 48 reaches the minimum oxygen concentration that could support combustion of benzene.

Operations since December 1995 indicate that for the current batch of waste, mixing pump operation increases the benzene release rate from the waste and that turning off the pumps essentially stops the release. The Board has been informed of the consequent belief that the actual rate of benzene release into the tank's headspace and its subsequent removal can be controlled through managing the action of the mixing pumps. This stratagem is to be followed in the tests as a means of maintaining the concentration of benzene in the headspace at a low enough level to prevent it from becoming flammable even if the oxygen concentration were to increase to an undesired level.

Westinghouse representatives also plan to impose a temperature limit for PVT-1 which is expected to prevent decomposition of TPB or to reduce its rate. Finally, they state that for PVT-1 the addition of TPB will be limited to 200 gallons of fresh 0.5 Molar sodium TPB solution, and that any subsequent additions during this experiment would be subject to review and approval by the Department of Energy. Westinghouse believes that this, in turn, would limit the maximum amount of additional benzene that could be produced. In effect, the amount of TPB added will be treated as an Operating Limit.

The Department and its contractor have brought substantial expertise to bear on understanding the science of the ITP process and the phenomena attending it. However, the Board is concerned that some important questions remain unanswered. First, the physical basis for holdup of large amounts of benzene in the waste and its removal through mixing pump operation is not yet well understood. Therefore, confidence in the ability to control its release is not as high as desired.

The Board is also concerned with the results of a recent laboratory-scale experiment using Tank 48 solution and TPB additive. The results from this experiment indicate that the amount of TPB which decomposed exceeded that

amount which had been added during the experiment, suggesting that the cesium and potassium TPB precipitates had also partially decomposed, presumably through catalytic attack. If the cesium and potassium TPB precipitates were subject to rapid and extensive attack by a catalyst, an enormous amount of benzene could be generated, and the rate of release could be rapid enough to overwhelm the removal capability of the purging system for Tank 48.

The Board concurs with the view that ITP is of high value for subsequent vitrification of the nuclear waste in the tanks at the Savannah River Site, and that further testing is necessary to gain a better understanding of the science of the process to assure safety during and after precipitation of the cesium. The Board believes that if it were conducted according to the limitations stated above, PVT-1 can be run safely and can help in leading to an improved understanding of the science and the mechanisms involved in the ITP process.

The present plan for conduct of PVT-2 involves new and untested nuclear waste and a much larger addition of TPB. Furthermore, the liquid in Tank 49, which contains TPB from the previously mentioned 1983 demonstration test, is to be used as the source of a significant part of the TPB to be added to Tank 48 during PVT-2. The Board understands that Tank 49 was also the source of TPB used in the one experiment which led to an apparent decomposition of precipitated cesium and potassium TPB. One very probable interpretation of that anomaly is that the material in Tank 49 contains an unknown catalyst which can attack the precipitated material and might also increase the rate of release of benzene by an amount that is unpredictable at present. Furthermore, waste from tanks not yet tested could contain unknown constituents that could also adversely affect the rate of production and release of benzene.

The Board believes that the uncertainty in understanding of the science of ITP would make it imprudent to proceed from PVT-1 to PVT-2 without substantial improvement in the level of understanding. Some such improvement may follow interpretation of the results of PVT-1. Better understanding of the anomalous experiment suggesting decomposition of TPB precipitates is also required.

Therefore, the Board makes the following recommendations:

1. Conduct of the planned test PVT-2 should not proceed without improved

understanding of the mechanisms of formation of the benzene that it will generate, and the amount and rate of release that may be encountered for that benzene.

2. The additional investigative effort should include further work to (a) uncover the reason for the apparent decomposition of precipitated TPB in the anomalous experiment, (b) identify the important catalysts that will be encountered in the course of ITP, and develop quantitative understanding of the action of these catalysts, (c) establish, convincingly, the chemical and physical mechanisms that determine how and to what extent benzene is retained in the waste slurry, why it is released during mixing pump operation, and any additional mechanisms that might lead to rapid release of benzene, and (d) affirm the adequacy of existing safety measures or devise such additions as may be needed.

John T. Conway,

Chairman.

Appendix—Transmittal Letter to Secretary of Energy

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700,
Washington, D.C. 20004 (202) 208-6400

August 14, 1996

The Honorable Hazel R. O'Leary,
Secretary of Energy, 1000 Independence
Avenue, SW, Washington, DC 20585-
1000

Dear Secretary O'Leary: On August 14, 1996, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. 2286a(a)(5), unanimously approved Recommendation 96-1 which is enclosed for your consideration. Recommendation 96-1 deals with the In-Tank Precipitation System at the Savannah River Site.

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

The Board will continue to review these preparations for routine activity in the In-Tank Precipitation System and will seek to ensure that Board actions do not delay this important program any more than may be needed for assurance of safety. Should the Secretary accept the recommendations, the Board is prepared to allocate priority resources in the form of Board members and staff to join in expedited development of a mutually acceptable Implementation Plan.

The Board will publish this recommendation in the Federal Register.

Sincerely,

John T. Conway,

Chairman.

Enclosure

c: Mr. Mark B. Whitaker, Jr.

[FR Doc. 96-21464 Filed 8-22-96; 8:45 am]

BILLING CODE 3670-01-M

APPENDIX B. PROGRESS TOWARD IMPLEMENTING PROVISIONS OF THE GOVERNMENT PLANNING AND REPORTING ACT OF 1993 (GPRA)

In 1993, Congress enacted, and the President signed, the Government Planning and Reporting Act (GPRA), which required federal agencies to develop five-year strategic plans including articulation of the agency's mission statement, goals, and proposed methods for achieving those goals. The first of these five-year plans must be submitted by the end of September 1997. Furthermore, commencing in fiscal year 1999, agencies are required by the GPRA to submit annual program performance plans to the Office of Management and Budget, establishing target levels of performance for program activities. The GPRA requires that performance target levels be defined in objective, measurable terms so that actual achievement can be compared against the targets. Agencies are also required to report annually to the President and Congress, presenting (1) program achievements compared with targets specified in the performance plans; and (2) when a target has not been met, an explanation of why, and a description of the actions needed to achieve the unmet goals.

The Board has applied the general principles set forth in the GPRA throughout its existence. The Board is fortunate in having an enabling statute that is quite specific regarding Congressional expectations. In each of its previous annual reports, the Board has reviewed its understanding of Congress' guidance (goals), and has described activities during the preceding year related to achievement of those goals. Thus, in at least a qualitative sense, the Board has been meeting the reporting requirements of the GPRA all along. Nevertheless, the Board has determined that some adjustments are appropriate to meet specific GPRA provisions. In particular, steps were taken during 1996 to initiate preparation of a formal five-year strategic plan that will meet the requirements of the GPRA, and to develop suitable, measurable performance goals.

The Board's initial efforts in this regard have highlighted difficulties arising from the impact of the performance of another agency (DOE) on achievement of legitimate goals for the Board itself. For example, it would be logical for an appropriate agency mission statement for the Board to include a desired ultimate *outcome* of Board actions along the lines of ". . . an absence of adverse health effects on any member of the public at large or on any worker at any defense nuclear facility operated by DOE . . ." The Board might achieve superlative quantitative measures of its performance against *output* goals, such as surpassing numeric goals for man-hours of effort by the Board staff in reviewing DOE activities, or receive outstanding qualitative assessments by independent outsiders of the cogency and clarity of applicable Board outputs (e.g., Board recommendations). Nevertheless, if performance by DOE or contractor elements were deficient, leading to undesirable consequences of facility operation, the Board would not have made acceptable progress toward achieving its mission statement. Conversely, if, in the face of hypothetical dereliction on the part of the Board and its staff, circumstances combined to result in no adverse health effects associated with DOE or contractor activities at defense nuclear facilities during a given reporting period, the *appearance* of acceptable Board performance toward achievement of its "no adverse effects" mission statement would be equally misleading.