



## **Defense Nuclear Facilities Safety Board**

### **22<sup>nd</sup> Annual Report to Congress February 2012**

**Required by Section 2286e of the  
Atomic Energy Act of 1954, as amended**

**“Above all, the Board must have a primary mission to identify the nature and consequences of any significant potential threats to public health and safety, to elevate such issues to the highest levels of authority, and to inform the public.”**

**Senate Report 100-232, Nuclear Protections and Safety Act of 1987, S. 1085, Committee on Armed Services, November 19, 1987.**

Peter S. Winokur, Chairman  
Jessie H. Roberson, Vice Chairman  
John E. Mansfield  
Joseph F. Bader

**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



February 17, 2012

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board is pleased to submit to Congress its Twenty-Second Annual Report for Calendar Year 2011. The Board is an independent executive branch agency responsible for making recommendations to the Secretary of Energy, and in certain cases to the President, necessary to ensure adequate protection of public health and safety at the Department of Energy's defense nuclear facilities.

As required by 42 U.S.C. § 2286e(a), this report describes the Board's current safety initiatives and assesses improvements in the safety of defense nuclear facilities as well as safety problems yet to be resolved.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Peter S. Winokur".

Peter S. Winokur, Ph.D.  
Chairman

A handwritten signature in black ink, appearing to read "Jessie H. Roberson".

Jessie H. Roberson  
Vice Chairman

A handwritten signature in black ink, appearing to read "John E. Mansfield".

John E. Mansfield  
Member

A handwritten signature in blue ink, appearing to read "Joseph F. Bader".

Joseph F. Bader  
Member

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**Hanford Tank Farms Under Construction, Circa 1949**

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## **I. The Board's Statutory Mission**

### **History and Legislation**

The 1970s and 1980s were turbulent decades for the nuclear industry worldwide. In 1975, a serious fire at the Browns Ferry nuclear power station nearly led to a core melt accident. Such an accident did take place four years later at the Three Mile Island power reactor site in Pennsylvania. These two watershed events caused the Nuclear Regulatory Commission to spend much of the 1980s seeking to impose new safety requirements on both operating reactors and reactors under construction. By 1986, much progress had been made, and the nuclear industry was “settling down.” Then in April of that year, the Soviet-built Chernobyl nuclear reactor in Ukraine exploded, causing the largest accidental release of radioactive material in history. While safety experts agreed that US-built power reactors did not share the flawed Chernobyl design, there was some concern with graphite-moderated reactors operated by the U.S. Department of Energy (DOE). Broader studies of DOE’s defense reactors revealed that safety improvements lagged far behind those being made in the commercial nuclear industry. Congress was also concerned about the slow pace of cleaning up the waste generated by decades of nuclear weapons production.

Beginning in 1987, Congress began to consider legislation imposing some kind of external oversight or regulation of DOE’s nuclear operations. Following two years of work by House and Senate committees, a compromise bill emerged based largely on Senator John Glenn’s original bill, S. 1085, *Nuclear Protections and Safety Act of 1987*. On September 28, 1988, President Reagan signed this bill into law as part of the National Defense Authorization Act for Fiscal Year 1989. The provisions relating to the Defense Nuclear Facilities Safety Board (Board) were later codified in the Atomic Energy Act of 1954, as amended, at 42 U.S.C. § 2286 et seq.

### **Mission, Jurisdiction, and Powers**

The Board is an independent federal agency within the executive branch of government, answerable to the President but also subject to oversight and direction by Congress. The five Board members, appointed by the President subject to confirmation by the Senate, are required by law to be “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.” The Board is a collegial agency, meaning that its actions are determined by the Board as a whole, by vote or by informal agreement. The Board’s chairman is chief executive officer.

The Board’s essential mission is to advise the Secretary of Energy on measures needed to ensure the safety of DOE’s “defense nuclear facilities,” a term defined in the Atomic Energy Act of 1954. This advice generally relates to preventing accidents affecting the public, workers, or both. Advice may be offered in a variety of ways, from informal exchanges between technical professionals to formal recommendations made on the public record to the Secretary of

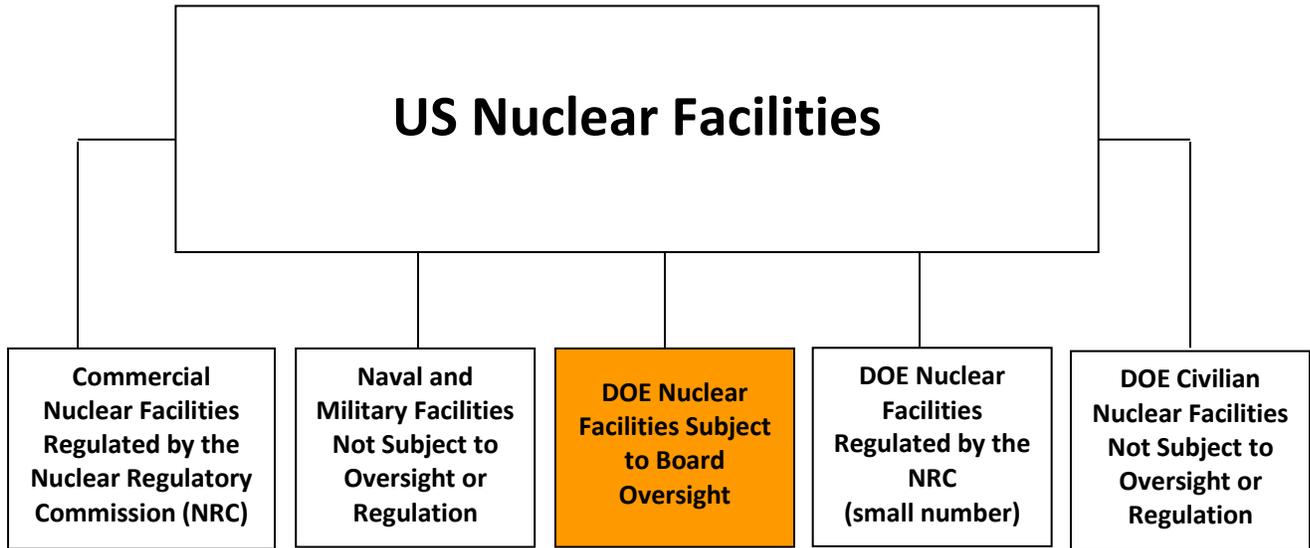
Energy. Safety measures may pertain to specific DOE facilities and activities or may be directed at the safety requirements and guides employed to regulate nuclear activities. Perhaps the most cogent summary of the Board's mission is that made by the Senate Committee on Armed Services in 1987: "Above all, the Board must have a primary mission to identify the nature and consequences of any significant potential threats to public health and safety, to elevate such issues to the highest levels of authority, and to inform the public."

As noted above, the Board's jurisdiction covers DOE's "defense nuclear facilities." The statute's definition is somewhat complex, but it can be understood in plain language. The Board is only concerned with facilities operated by DOE that are (1) covered by the Atomic Energy Act and (2) have a function related to national defense. This scope leaves out two major classes of government-regulated nuclear facilities: DOE's nuclear projects that are civilian in purpose, and commercial nuclear facilities regulated by the Nuclear Regulatory Commission. The Board's oversight jurisdiction does not extend to the U.S. Navy's nuclear propulsion program nor to environmental hazards regulated by other federal and state agencies. The schematic figure on page 7 categorizes US nuclear facilities, while the table below the figure lists the major sites that the Board oversees.

The Board's oversight mission covers all phases in the life of a defense nuclear facility: design, construction, operation, and decommissioning. During the Board's more than two decades of work, some major sites have closed (such as Rocky Flats in Colorado), while other major facilities have been or are being built (such as the Waste Treatment and Immobilization Plant at Hanford in Washington State).

To carry out the mission outlined above, Congress granted the Board an effective suite of statutory tools. Principal among these is the formal Board recommendation issued to the Secretary. The statute requires the Secretary to either accept or reject the Board's recommendation, and in the case of an acceptance, to write and execute an implementation plan. This process all takes place on the public record. In cases involving an "imminent or severe threat" to the public health and safety, the statute requires the Board to also send its recommendation to the President, who makes the final decision on actions to be taken. In addition to recommendations, the Board is empowered to hold public hearings (and subpoena witnesses if necessary), conduct investigations, demand information and documents needed for the Board's work, and review and comment on DOE requirements and standards affecting safety at defense nuclear facilities. DOE is required by law to grant the Board "ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities." Finally, the statute empowers the Board to seek assistance from other federal agencies (such as the Nuclear Regulatory Commission) and from organizations outside the government (such as the National Academy of Sciences).

**Defense Nuclear Facilities**



**Major Sites Subject to Board Jurisdiction**

<b>Site</b>	<b>Location</b>	<b>Operations</b>	<b>DOE Website</b>
Hanford Site	Richland, Washington	Cleanup and decommissioning	<a href="http://www.hanford.gov">http://www.hanford.gov</a>
Idaho National Laboratory	45 miles west of Idaho Falls, Idaho	Storage and processing of radioactive waste	<a href="http://www.inl.gov">http://www.inl.gov</a>
Lawrence Livermore National Laboratory	50 miles east of San Francisco, California	Research to support the nuclear weapons arsenal	<a href="https://www.llnl.gov">https://www.llnl.gov</a>
Los Alamos National Laboratory	Los Alamos, New Mexico	Research to support the nuclear weapons arsenal; manufacturing of nuclear weapon components	<a href="http://www.lanl.gov">http://www.lanl.gov</a>
Nevada National Security Site	Northwest of Las Vegas, Nevada	Disposition of damaged nuclear weapons; nuclear fission and subcritical experiments; waste management	<a href="http://www.nv.doe.gov">http://www.nv.doe.gov</a>
Oak Ridge National Laboratory	Oak Ridge, Tennessee	Energy research; treatment and disposal of radioactive wastes	<a href="http://www.ornl.gov">http://www.ornl.gov</a>

**Major Sites Subject to Board Jurisdiction (cont.)**

<b>Site</b>	<b>Location</b>	<b>Operations</b>	<b>DOE Website</b>
Pantex Plant	Near Amarillo, Texas	Maintenance of the US nuclear stockpile	<a href="http://www.doeal.gov/pxso">http://www.doeal.gov/pxso</a>
Sandia National Laboratories	Albuquerque, New Mexico	Nuclear research; support for weapons stockpile maintenance program	<a href="http://www.sandia.gov">http://www.sandia.gov</a>
Savannah River Site	Aiken, South Carolina	Tritium extraction, recycling and storage; management and treatment of radioactive wastes; nuclear materials storage and disposition; research and development	<a href="http://www.srs.gov">http://www.srs.gov</a>
Waste Isolation Pilot Plant	26 miles east of Carlsbad, New Mexico	Safe disposal of transuranic waste in underground repository	<a href="http://www.wipp.energy.gov/">http://www.wipp.energy.gov/</a>
Y-12 National Security Complex	Oak Ridge, Tennessee	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	<a href="http://www.y12.doe.gov/">http://www.y12.doe.gov/</a>

## II. Highest-Priority Safety Problems

### Earthquake Hazard at Los Alamos National Laboratory

A severe accident at the Plutonium Facility (PF-4) at Los Alamos National Laboratory would present a significant risk to the public, and is therefore one of the Board's greatest safety concerns. On October 26, 2009, the Board issued Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*, which recommended actions to protect the public from the consequences of a large earthquake and subsequent large fire at PF-4. The Board followed up by issuing Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*, to address DOE's interpretation of its Nuclear Safety Management Rule (10 CFR Part 830) and the associated DOE standard<sup>1</sup> for preparing documented safety analyses. The rule and the standard form the underpinning for ensuring adequate protection of the public at DOE's defense nuclear facilities. The standard establishes a 25 rem Evaluation Guideline for offsite exposure. If conservatively calculated accident consequences approach the Evaluation Guideline, safety controls are required to achieve adequate protection of the public by reducing offsite exposure. The Board was concerned that managers at the National Nuclear Security Administration (NNSA) had approved the 2008 documented safety analysis for PF-4 as compliant with the rule and the standard, when the postulated accident consequences were two orders of magnitude (factor of 100) greater than the Evaluation Guideline and three orders of magnitude (factor of 1,000) greater than what might be considered an acceptable consequence (that is, 10% of the Evaluation Guideline).

In response, NNSA took immediate actions to reduce the material at risk, combustible materials, and ignition sources. NNSA also completed analyses confirming that a large earthquake will likely damage the PF-4 structure and many of its safety systems. As a result, NNSA reinforced several structural elements, including the roof. The Board's ongoing review of NNSA's analyses has identified additional structural concerns that NNSA is still working to resolve.

The Board held a public hearing in Santa Fe, New Mexico, on November 17, 2011, to discuss NNSA's plan to mitigate the remaining risks. Further analyses to determine whether the current structure of the facility can survive an earthquake must be completed. The Board is not satisfied with the slow schedule for upgrading critical safety systems to survive an earthquake, particularly the ventilation system relied on to contain radioactive material released inside the building. The Board continues to insist that NNSA clearly define "adequate protection" for the public and the workers and show how PF-4 will provide such protection in the future.

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<sup>1</sup> DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

## **Safety Implications of Facility Design Changes**

Safety issues have arisen at DOE's major design and construction projects as a result of DOE and its contractors altering safety-related aspects of the design without sufficient basis. The most prominent examples involve the Hanford Waste Treatment and Immobilization Plant and the Uranium Processing Facility at the Y-12 National Security Complex (see Section VII for details on these projects). Altering safety aspects of the design without adequately understanding the associated technical difficulties, complexities, or project risks involved can reduce the safety margin of the design, create new safety issues, and imperil the success of the project. Furthermore, maintaining consistency between the design and the safety analysis is the most efficient and cost-effective approach. In a properly managed nuclear project, and consistent with DOE's own requirements, safety features of the design should be decided upon during conceptual design, and revised later only when there is a solid technical basis justifying the change.

## **Overhaul and Reduction of Safety Directives**

Robust oversight, both by line management and independent oversight organizations, is fundamental to assuring safety at defense nuclear facilities. The Board remains the last line of defense to ensure DOE line management implements safety requirements needed to prevent accidents. In pursuit of more efficient operations, DOE is undertaking initiatives to (1) create and test new governance models that rely more heavily on line organizations for safety oversight and (2) eliminate or streamline complex-wide directives and contractual requirements. Both of these initiatives make greater demands on the Board to provide effective independent oversight.

In 2011, DOE made significant changes to its directives system governing construction, operations, maintenance, and decommissioning of defense nuclear facilities. By year's end, 49 directives had been cancelled, and 53 more were revised or recertified. The Board reviewed every change made to each safety-related directive, and in many instances strongly advised against changes that weakened essential safety requirements. DOE retained the majority of the safety requirements in its directives system; however, some requirements were removed or weakened over the Board's objections. In other instances, the Board's input enabled DOE to strengthen key directives for startup of nuclear facilities and quality assurance programs.

The next phase of this directives overhaul is implementation of the revised directives. The Board continues to question, as it did during its May 25, 2011, public hearing, whether DOE can assure that the modified directives are adequate to maintain nuclear safety. The Board will closely monitor implementation in the field.

## **Maintaining Adequate Safety Controls**

The Board has intervened in a series of cases where DOE and NNSA sought to use less conservative accident calculations to downgrade engineered safety systems. The Board is

particularly concerned with DOE's and NNSA's reduced emphasis on following the well-established "hierarchy of controls" defined in DOE Standard 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. This standard dictates that engineered structures, systems, and components are to be preferred over reliance on administrative controls. Such preference is based on the uncertainty of human performance. The Board sent DOE several letters in 2010 and 2011 pointing out, and seeking the technical basis for, improper changes in safety philosophy and analysis. Examples of such changes include:

- At the Tritium Facility at Lawrence Livermore National Laboratory, the contractor proposed removing the credited safety function of a glovebox that confines radioactive gases, and relying instead on an alarm to alert workers that tritium gas has been released.
- At the Y-12 National Security Complex (Y-12), NNSA approved removing the analysis of chemical and toxicological hazards from the safety basis for the Highly Enriched Uranium Materials Facility, and then directed the contractor to evaluate downgrading some or all fire safety measures credited in the safety analysis, including the secondary confinement system. The Safety Design Strategy for the Uranium Processing Facility, currently in design, likewise excluded toxicological hazards from the safety analysis.
- At the Hanford Tank Farms, DOE approved downgrading the safety importance of ventilation systems that limit the accumulation of flammable gas and thereby help to prevent explosions in the high-level waste tanks.
- At the Savannah River Site's Tritium Facilities, NNSA approved downgrading engineered safety controls that would prevent large releases of tritium. The safety basis was revised to specify mitigative and administrative controls, such as requiring workers in the vicinity of the facilities to take shelter until the plume of tritium released in an accident leaves the area.

The Board is closely monitoring DOE's current effort to revise DOE Standard 3009 to ensure that it continues to specify the correct hierarchy of safety controls. The Board sees many of DOE's actions as a reduction of defense-in-depth, which should instead be strengthened in light of lessons learned from the Fukushima reactor accident in Japan and the Deepwater Horizon oil spill in the Gulf of Mexico.

### **Storage and Disposal of Nuclear Materials**

DOE faces several challenges pertaining to defense-related nuclear wastes and surplus nuclear materials. These materials exist in many chemical and physical forms, including large inventories of plutonium, uranium, used nuclear fuel, and other highly radioactive isotopes. More materials are being added to these inventories as DOE ends Cold War era programs, decommissions old nuclear facilities, and uncovers or produces additional wastes during site

cleanup work. Three main challenges exist: (1) DOE must provide safe interim storage for these materials, (2) DOE must develop timely disposition plans to limit the risks to workers and the public, and (3) DOE must identify the facilities and infrastructure needed to complete the disposition mission.

On February 28, 2011, the Board sent a letter to DOE expressing concerns about the potential premature shutdown of the nation's only large-scale radiochemical processing facility, the Savannah River Site's H-Canyon. Shutting it down could have significant unintended safety consequences due to the orphaning of unprocessed materials. During the Board's public hearing at the Savannah River Site on June 17, 2011, DOE committed to develop a resumption plan for H-Canyon. Later in 2011, DOE directed the facility's contractor to use H-Canyon and the associated HB-Line facility to process up to 3.7 metric tons of plutonium materials. DOE also directed its contractor to prepare to process Sodium Reactor Experiment Fuel, one of the least stable forms currently in storage in Savannah River's L Basin. However, DOE has still not made any decision regarding processing the remaining spent fuel inventory at the Savannah River Site.

### **III. Recommendations to the Secretary in 2011**

On June 9, 2011, the Board transmitted Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*, to the Secretary. The full text of the recommendation is reprinted in Appendix A to this report. (See Section VII for a full discussion of safety issues at this facility.)

The Board initiated an investigation into the safety culture of the Hanford Waste Treatment and Immobilization Plant project upon receipt of a letter dated July 16, 2010, from Dr. Walter Tamosaitis, a technical professional employed at this project. While the investigation into Dr. Tamosaitis's allegations was underway, the Board conducted a public hearing with DOE and its principal contractors in Kennewick, Washington, to explore certain design issues. During the public hearing, the Board came upon information suggesting that DOE and contractor management improperly restricted technical views expressed in testimony. Based on this information, the Board extended the ongoing investigation into a second phase focused on testimony at the public hearing. Meanwhile, the Board continued to investigate Dr. Tamosaitis's allegations. (See Section X of this report for information on the Board's investigative powers and other matters related to investigations.)

Following a series of interviews and closed hearings held in the first quarter of 2011, the Board reviewed evidence collected and concluded that prompt action needed to be taken by the Secretary. The Board therefore issued Recommendation 2011-1 and closed the investigative record.

On June 30, 2011, the Secretary of Energy responded by affirming the importance of a robust safety culture and identifying several near-term actions to improve the safety culture on the project and to evaluate safety culture at other sites and projects. However, the Secretary's response rebutted some of the Board's findings. The Board provided additional detail to the Secretary in a letter dated August 12, 2011, to assist DOE in developing a satisfactory response to the recommendation. On September 19, 2011, the Secretary provided clarification of his acceptance of the recommendation. The implementation plan for this recommendation was submitted to the Board on December 27, 2011, and is under review.

#### **IV. Open Prior Recommendations**

##### **Recommendation 2000-1, *Prioritization for Stabilizing Nuclear Materials***

The Board issued Recommendation 2000-1 as a follow-up to Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*. Recommendation 94-1 identified the need to remediate large amounts of nuclear materials in liquid and solid form that remained in the manufacturing pipeline at the end of the Cold War. In this recommendation, the Board sought to re-establish the priority for stabilizing the materials that remained after six years of effort to implement the original recommendation. The Board noted that Savannah River Site, Hanford, Rocky Flats, and Los Alamos National Laboratory possessed most of the legacy materials that were significantly behind schedule for remediation.

As of 2011, a tremendous amount of material has been stabilized, and the greatest hazards have been remedied. The only commitments remaining involve spent fuel sludge at Hanford and plutonium at Los Alamos National Laboratory. However, these commitments are years overdue with respect to the completion dates listed in DOE's implementation plan. The Board is working with DOE to obtain an updated plan that accurately reflects expected completion dates for the remaining stabilization activities.

##### **Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls***

Recommendation 2002-3 identified the need for additional requirements for administrative controls used to assure safety at defense nuclear facilities. In response to the recommendation, DOE developed new requirements, standards, and training to ensure the reliability and effectiveness of administrative controls throughout the defense nuclear complex. All of the deliverables identified in DOE's implementation plan have been provided to the Board. However, the Board has held off closing the recommendation until DOE shows that the new requirements have been integrated into practices at its defense nuclear facilities. During 2011, the Board monitored DOE's review of the implementation of the recommendation at a number of high hazard facilities. The Board expects DOE to propose closing this recommendation in 2012.

##### **Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations***

The Board issued Recommendation 2004-1 to ensure that changes to DOE's organizational structure and practices were done formally and deliberatively, with due attention to unintended safety consequences that could reduce the safety of defense nuclear facilities. The recommendation had its origins in the Board's belief that DOE should benefit from lessons learned in the Columbia Space Shuttle disaster and the corroded reactor vessel at the Davis-Besse nuclear power plant. This belief has been heightened today by the Fukushima reactor accident and the Deepwater Horizon oil spill. The recommendation reinforced DOE's

basic safety strategy as embodied in the core functions and guiding principles of integrated safety management.

The majority of the commitments in the DOE implementation plan for Recommendation 2004-1 have been completed. The remainder were due in 2009, but were not accomplished on time. One of the commitments was closed this year, but it is not clear when the others will be completed. Some previous improvements have degraded as a result of changes in DOE's safety directives, its approach to management and oversight, or reduced emphasis.

The Board held a public hearing on DOE's safety oversight on May 25, 2011, to reexamine the status of implementation. This hearing, the third in a series, examined federal safety management and oversight policies that DOE was developing. Senior DOE and NNSA leadership confirmed their ongoing support and commitment to integrated safety management and shared their vision for oversight across the DOE complex. The public hearing was effective in heightening the awareness of senior DOE and NNSA leadership to the need for maintaining effective safety management and oversight systems for defense nuclear facilities. The Board will continue to conduct reviews of key aspects of this recommendation as DOE completes its implementation.

#### **Recommendation 2004-2, *Active Confinement Systems***

In the summer of 2010, DOE completed its evaluation of all defense nuclear facilities in accordance with the implementation plan for this recommendation. NNSA concluded that the Plutonium Facility at Los Alamos was its only facility requiring upgrades. DOE's Office of Environmental Management had an independent team study the results of the evaluations for its facilities and prioritize them according to their safety enhancement value and cost effectiveness. The team recommended that DOE initiate projects to modify or upgrade the active confinement ventilation systems in selected facilities at Savannah River and Hanford, in order to meet the performance criteria established in the DOE Guide prepared for this purpose. In a letter dated October 1, 2010, DOE committed to make these upgrades and brief the Board within one year on the progress made in enhancing the reliability of those systems. In 2011, contractors at the Savannah River Site evaluated the proposed modifications in more detail and concluded that different modifications to their ventilation systems would be more cost-effective. The results of these evaluations have yet to be released formally to the Board.

The Board continued reviewing the design of new facilities, such as the Uranium Processing Facility at Y-12 and the Chemistry and Metallurgy Research Replacement facility at Los Alamos, to confirm that an active confinement system remains in the design of those facilities. The Board believes that active confinement systems are critically important in facilities like the Los Alamos Plutonium Facility, because such systems prevent the release of radioactive materials in accidents. As part of the implementation plan, DOE committed to revise its directives to ensure that active confinement systems are the preferred option in designing new facilities. DOE is currently revising the pertinent directives to implement this commitment.

### **Recommendation 2005-1, *Nuclear Material Packaging***

The Board issued Recommendation 2005-1 to improve protection for workers involved in the storage and handling of nuclear materials. DOE provided the final implementation plan deliverable, a DOE-wide plan and schedule for implementing DOE Manual 441.1-1, *Nuclear Material Packaging Manual*, in September 2009. The Board has kept the recommendation open to track DOE's execution of that plan. In 2011, the Board provided oversight of DOE's efforts to qualify containers to the requirements of the Packaging Manual. Safety analysts at Los Alamos National Laboratory submitted the initial safety analysis for a new container for plutonium to NNSA's Office of Package and Transportation in January 2011 for review and comment. Los Alamos personnel expect to resolve the comments they received and submit the final safety analysis for approval in February 2012. Several other sites also plan to use this container once it is approved. Only NNSA's Los Alamos Site Office has developed a formal process for approving its contractor's technical basis for nuclear material packaging and surveillance of packages as required by the Packaging Manual.

Personnel at the Y-12 National Security Complex had previously developed conceptual designs for several improved containers for the storage of uranium. However, the Y-12 approach now is to show through research that the hazards of uranium are too low to necessitate the protection provided by the new containers. This approach is allowed and described in an appendix to the Packaging Manual. Y-12 analysts are attempting to show that a worker's internal radiation dose from a large uptake of weapons grade uranium oxide would be less than five rem committed effective dose equivalent. The Board is monitoring this effort.

### **Recommendation 2007-1, *Safety-Related In Situ Nondestructive Assay of Radioactive Materials***

The Board continued to evaluate DOE's progress in implementing Recommendation 2007-1. Although responsibility for this recommendation was transferred from DOE's Office of Environmental Management to NNSA, milestones from the implementation plan continued to be met, including development of an action plan to address gaps in training and qualification, equipment capabilities, directives, research and development, quality assurance, and oversight. The need for nondestructive assay techniques will grow as DOE designs new facilities and decommissions old ones.

### **Recommendation 2008-1, *Safety Classification of Fire Protection Systems***

Recommendation 2008-1 identified the need for standards for the design and operation of fire protection systems relied upon to protect the public and workers from radiological hazards at defense nuclear facilities. DOE issued the first major deliverable of the implementation plan—interim guidance for the design and operation of wet pipe sprinkler systems and supporting water supplies—in 2010. Several projects are now using this guidance in preparing their designs. DOE continues to work on developing the comprehensive set of attributes of safety-related fire protection systems that the Board recommended, but it is

taking far longer than DOE originally expected. DOE now plans to complete the final directives in early 2012. The Board is continuing to work with DOE to complete this effort.

### **Recommendation 2009-1, *Risk Assessment Methodologies at Defense Nuclear Facilities***

Recommendation 2009-1 identified the need for policies, standards, and guidance to govern the use of quantitative risk assessment methodologies for safety applications at DOE defense nuclear facilities. In response, DOE issued a complex-wide information notice discussing allowable uses of risk assessment in 2010, and drafted a standard for probabilistic risk assessment for trial use and comment. In April 2011, DOE issued a new departmental policy on nuclear safety<sup>2</sup> that covered the appropriate use of quantitative and probabilistic risk assessment. The Board reviewed the policy during its development and agrees that it specifies the correct limitations. Despite the progress achieved, quantitative risk analysis continues to be used in an ad hoc manner in the safety analyses for some defense nuclear facilities, and DOE has not yet identified any applications of the new policy. The Board continues to monitor DOE's efforts to identify suitable pilot applications of the new standard.

### **Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety***

The Board issued Recommendation 2009-2 on October 26, 2009, to reduce the risk posed by an earthquake and subsequent fire at the Los Alamos Plutonium Facility (PF-4). The Secretary submitted an implementation plan for the recommendation on July 13, 2010. The laboratory took several immediate steps to reduce risk. These included reducing the quantity of material at risk in the facility, instituting new controls on combustible materials and heat sources, installing robust safes to more safely store material, and installing automatic shutdown switches to de-energize equipment upon detection of an earthquake to reduce the likelihood of a fire.

The implementation plan committed to complete a more detailed earthquake analysis using the most recent information about possible earthquakes at the site. Los Alamos analysts completed this effort for PF-4 in May 2011. They identified nine ways in which the PF-4 structure could fail and release radioactive materials during an earthquake. Most importantly, they identified a weakness in the roof that could result in collapse of the building. As a result, the laboratory instituted compensatory measures and established a method to isolate leak paths to the environment that could result from failure of components inside the facility. In October 2011, the laboratory completed installation of a reinforcing beam on the roof intended to prevent the collapse of the facility in an earthquake. However, further analyses must be completed to determine whether the current structure of the facility can survive an earthquake.

One implementation plan deliverable remains open. Some gloveboxes contain high temperature equipment that could topple over in an earthquake and start a fire. Upgrades to

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<sup>2</sup> DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*.

these gloveboxes are expected to begin in April 2012. Also, a Project Execution Plan that outlines in greater detail the strategy to upgrade important facility safety systems (such as the fire suppression system and the confinement ventilation system) is due to be resubmitted by August 2012. The Board is briefed regularly by NNSA and laboratory personnel to understand the path forward and ensure the corrective actions will provide adequate protection of the public and workers. The Board conducted a public hearing in Santa Fe, New Mexico, on November 17, 2011, with a focus on earthquake safety at PF-4.

***Recommendation 2010-1, Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers***

A lack of clarity in DOE directives and standards for nuclear facility safety analyses played a major role in the need for Recommendation 2009-2. For this reason, the Board sent a letter to DOE on March 15, 2010, seeking DOE's interpretation of its standards for providing adequate protection of the public and the workers. DOE's response dated June 10, 2010, was not clear, giving the impression that the applicable DOE standard is open to interpretation. Since adequate protection of the public and workers can only be ensured by strict compliance with a specific set of nuclear safety requirements, the Board concluded that some DOE standards have to be revised to clarify what constitutes adequate protection. The Board issued Recommendation 2010-1 to ensure that DOE defines a clear and unambiguous set of nuclear safety requirements.

DOE partially accepted the recommendation on February 28, 2011. DOE rejected the portion of the recommendation related to existing defense nuclear facilities where an accident could cause offsite doses exceeding well-established safety criteria. DOE stated that the responsible Program Secretarial Officer had evaluated the safety measures taken or planned for those facilities and concluded they were adequate. DOE also stated that it would consider the Board's recommendations regarding specific changes to safety requirements but that further analysis was needed to determine the exact changes to make. DOE also committed to refine the requirements and standards that govern federal approval authority, including processes and criteria for those instances where the established safety criteria are not met. DOE is scheduled to submit the first of the revised safety standards for the Board's review in April 2012.

***Recommendation 2010-2, Pulse Jet Mixing at the Waste Treatment and Immobilization Plant***

On December 17, 2010, the Board issued Recommendation 2010-2 to resolve potential nuclear safety hazards at the Waste Treatment and Immobilization Plant. The recommendation focused on the need for large-scale testing to demonstrate the performance of mixing and transfer systems using representative simulants. DOE submitted its implementation plan on November 10, 2011, and the Board accepted it on January 19, 2012. During this interim period DOE continued testing and obtained results inconsistent with an important assumption in the implementation plan. A revised implementation plan may be required.

## **V. Emergency Preparedness, Response, and Recovery**

Nuclear facilities of all kinds, civilian and defense, are designed with safety systems to prevent accidents. Should an accident occur, a second set of systems is intended to prevent the release of radioactive materials to the environment. Experiences such as the accidents at Three Mile Island in 1979 and Fukushima in 2011 have shown, however, the prudence of a third layer of safety measures known as emergency planning and preparedness. These measures are premised on the possibility that a release of radioactive material could occur, in spite of all the engineered safety systems and confinement barriers provided in nuclear facilities.

Emergency preparedness, response, and recovery have been areas of emphasis for the Board. The Board is particularly interested in improving DOE's preparedness to respond to low-probability, high-consequence accidents. Although such accidents are unlikely, DOE must be prepared for them. Major natural disasters can affect multiple facilities simultaneously, destroy the infrastructure needed to reach or evacuate the site of the accident, damage emergency response equipment, and result in conflicting needs for emergency response for defense nuclear facilities and the local community.

The Board has focused its attention on (1) DOE's ability to respond to natural disasters that can affect multiple facilities at a site; (2) cascading events, such as an earthquake that starts a wildland fire, or an earthquake that causes flooding by collapsing dams; and (3) the impacts of the loss of utilities and supporting infrastructure on DOE's ability to respond to a disaster. The Board has also addressed the need for DOE to coordinate with local agencies when responding to an emergency. Finally, the Board has placed special emphasis on the lessons learned from the Fukushima accident.

In general, the Board has found that emergency preparedness programs at defense nuclear facilities vary in effectiveness. Improvements have been made periodically, in response to reviews by DOE and the Board, but such improvements are not always consistently maintained over the long-term. An effective emergency preparedness program must be maintained at a high level of readiness and regularly tested by drills. Otherwise it does not perform its intended function as an element of defense in depth.

The Board received testimony on emergency preparedness in its 2011 public hearings at the Savannah River Site and the Los Alamos National Laboratory. In a letter to the NNSA administrator dated August 19, 2011, the Board questioned the effectiveness of emergency preparedness at the Savannah River Site as a safety measure for the tritium facilities. NNSA responded to this letter on November 14, 2011. In its response, NNSA committed to a more extensive and realistic drill program to test the effectiveness of emergency preparedness for the tritium facilities. The Board's site representatives at Savannah River Site will witness these drills in 2012 to determine whether genuine improvements have been made.

## VI. Nuclear Weapon Operations

The Board is responsible for ensuring the safety of DOE's operations with nuclear weapons. These operations include making nuclear weapons components, taking apart retired weapons, disassembling active weapons for surveillance and maintenance, and reassembling weapons for deployment by the armed forces. The Board also provides safety oversight of the handling and storage of special nuclear material and tritium, and of DOE's nuclear weapon research and development work.

### Seismic Safety at the Los Alamos Plutonium Facility

The Plutonium Facility (PF-4) at Los Alamos National Laboratory plays a unique role in supporting NNSA's mission. It was chosen as the long-term location for NNSA's plutonium processing, purification, and component fabrication.

Of the many accident scenarios that could affect PF-4, earthquakes have always been a particular concern because they have the potential to affect all material stored in the building



**Plutonium Facility, Los Alamos**

and to cause large releases and large doses to the public. The potential for earthquakes at each of NNSA's sites is required to be re-evaluated periodically. In May 2007, the laboratory contractor published an updated analysis that highlighted a significant increase in the potential earthquake activity at the site. A significant increase in the possible vertical ground motion was of particular concern. The contractor

initiated detailed analyses of several facilities, including PF-4, to determine the safety implications of this information.

In December 2008, NNSA approved a major revision to PF-4's safety basis. This analysis did not account for the increased earthquake hazard that was still being evaluated by the laboratory. Nonetheless, the accident presenting the highest offsite consequence was an earthquake followed by a large facility fire. Critical safety systems needed to protect workers and the public, including the fire suppression system and the confinement ventilation system, are not expected to survive a large earthquake.

As a result, the Board issued Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*, which sought actions by DOE to protect the public from the

consequences of a large earthquake at PF-4. More details about this recommendation can be found earlier in this Annual Report.

Contractor personnel at the laboratory completed the new seismic analysis for PF-4 in May 2011. They identified nine ways in which the PF-4 structure could fail and release radioactive materials during an earthquake. The most important finding identified a weakness in the roof that could result in collapse of the building.

Laboratory personnel took several actions to reduce the risk posed by these vulnerabilities. They instituted compensatory measures to limit the material at risk in PF-4 and restrict access to vulnerable areas, and established a method to isolate leak paths to the environment that could result from failure of components inside the facility. In October 2011, the laboratory contractor completed installation of a reinforcing beam on the roof intended to prevent the collapse of the facility from the failure of the roof girders in an earthquake.

The Board remains concerned about safety at PF-4, as many of the questions regarding the building's response to a major earthquake are yet unanswered. The Board conducted a public hearing in Santa Fe, New Mexico, on November 17, 2011, with a focus on earthquake safety at PF-4. NNSA and contractor engineers committed to provide information and analyses regarding facility weaknesses that could lead to release of radioactive materials and high risk to the public. The Board continues to work closely with NNSA and contractor personnel on this topic.



**PF-4 Public Hearing, November 2011**

### **Weaknesses in Safety Basis Documents and Associated Controls**

DOE's Nuclear Safety Management Rule (10 CFR Part 830) requires contractors to "perform work in accordance with the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility and, in particular, with the hazard controls that ensure adequate protection of workers, the public, and the environment." The rule requires the contractor to prepare a documented safety analysis and establish hazard controls to ensure adequate protection of workers, the public, and the environment. The Board reviewed documented safety analyses at many of NNSA's defense nuclear facilities during 2011 and found weaknesses that required correction.

**Pantex, Nuclear Explosive Operations.** The Pantex Plant, located near Amarillo, Texas, serves a central role in managing the nuclear stockpile. Operations at the site include assembly, disassembly, dismantlement, and surveillance of weapons, as well as storage of special nuclear material removed from retired weapons. Pantex has a particularly complicated authorization basis<sup>3</sup> that consists of eleven safety analysis reports describing facilities and nine hazard analysis reports describing nuclear explosive operations. In Recommendation 98-2, *Safety Management at the Pantex Plant*, the Board encouraged Pantex to refine its practices for developing the safety analyses and controls. As part of its ongoing oversight, the Board conducted detailed reviews of the calculations supporting Technical Safety Requirements<sup>4</sup> in selected safety analysis reports. The Board identified deficiencies which included:

- failure to implement safety controls for certain credible accident scenarios, based solely on initiating event probabilities, which should not be a consideration once the weapon design laboratory has determined the event is credible,
- failure to protect weapons from “tripping man” impacts that exceed what has been analyzed as safe by the design agencies,
- analyses that relied on inputs, assumptions, and methodologies that could not be defended without additional analysis, and
- the lack of a clear technical basis for probabilistic estimates used in analyses.

In March 2011, the Board and NNSA conducted a joint workshop to assist Pantex in establishing a “Documented Safety Analysis Upgrade Initiative.” NNSA is implementing this initiative and has committed to a comprehensive review of the technical basis for required safety controls.

**Lawrence Livermore National Laboratory, Tritium Facility.** NNSA authorized new operations at the Tritium Facility in November 2009. The primary purpose of these operations is to fill targets with tritium to be used in the National Ignition Facility.

During 2010 and 2011, the Board reviewed the safety basis for the Tritium Facility, and on May 16, 2011, issued a letter to NNSA identifying shortcomings. Specific concerns included (1) removing the credited safety function of the glovebox; (2) relying on emergency

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<sup>3</sup> The Board considers the authorization basis to be the composite of information a contractor must provide in response to all environment, safety, and health requirements applicable to a facility. The information provided in the authorization basis should, at a minimum, include identification of the hazards of the work, analysis of those hazards, and identification of required controls.

<sup>4</sup> Technical safety requirements are the safety limits, operating limits, surveillance requirements, administrative and management controls, design features, etc., that establish the specific parameters and requisite actions for the safe operation of a nuclear facility.

preparedness protocols in the safety basis to protect workers in the event of a large fire, instead of designating and controlling the fire suppression system to protect workers; and (3) failing to show that all explosion scenarios involving tritium and other hydrogen isotopes are prevented. In response, NNSA directed several improvements, and contractor analysts submitted formal changes to the Tritium Facility safety basis in November 2011. Examples of the corrective actions include (1) retaining the glovebox's designation as credited safety equipment, (2) implementing a specific administrative control<sup>5</sup> to limit hydrogen operations in the event of a fire, and (3) restricting the amount of tritium and other hydrogen isotopes in a given glovebox to below the lower flammability limit.

**Nevada National Security Site, National Criticality Experiment Research Center.** This year, NNSA authorized operations at the National Criticality Experiment Research Center. At this facility, site operators conduct criticality experiments<sup>6</sup> using assemblies named Comet, Flat-Top, Godiva, and Planet. The assemblies can accommodate different fissile materials and configurations to support a variety of experiments. The Board has provided close oversight of NNSA's safety basis and preparations for startup of these activities.

In 2010 and 2011, the Board reviewed the safety basis for the critical assemblies and noted several deficiencies. As a result, NNSA managers imposed hold points and limitations on the operation of the critical assemblies during startup. They also completed or proposed further corrective actions including revisions to the safety basis:

- The accident analysis for the Godiva critical assembly will be modified to include consequences of vaporizing all plutonium present.
- The material loading limits for the Comet and Planet critical assemblies will be controlled to be consistent with the assumptions in the accident analysis.
- The safety analysis will not rely on the operators to perform safety functions.
- Nuclear instrument set points and system response times will be determined and included in experiment plans to ensure they can be executed safely.



**Flat-Top Critical Assembly**

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<sup>5</sup> An administrative control is designated as a specific administrative control if (1) it is identified in the documented safety analysis as a control needed to prevent or mitigate an accident scenario and (2) it has a safety function that would be safety-significant or safety-class if the function were provided by an engineered control.

<sup>6</sup> Criticality experiments use laboratory-scale equipment to train personnel on nuclear criticality safety and provide precise nuclear data for nuclear counter terrorism, stockpile stewardship, and criticality safety.

The Board remains concerned that the instrumentation and control system, which performs an important safety function, may not be adequately designed and maintained. The Board plans continued close oversight to ensure that NNSA corrects this weakness.

**Savannah River Site, Tritium Facilities.** The Tritium Facilities have four main missions: (1) recycle tritium from existing warheads and extract new tritium from target rods irradiated in commercial power reactors, (2) replenish and purify tritium in the nuclear weapon stockpile, (3) evaluate the reliability of tritium gas delivery systems, and (4) recover and purify helium-3 produced by decay of tritium.

The Board has performed regular oversight of these activities and conducted a detailed review of the safety analysis and controls in 2011. On August 19, 2011, the Board issued a letter to NNSA noting several deficiencies:

- an undesirable shift toward safety controls that seek to reduce the consequences of accidents instead of preventing them,
- a weak technical basis for the parameters used in the radiological consequence analyses that determine the required pedigree of safety controls, and
- a less-than-effective emergency preparedness program to protect nearby workers.

On November 14, 2011, NNSA provided a response to the Board's letter and committed to actions including multi-facility emergency drills. NNSA also initiated interim controls such as reducing the quantity of material at risk allowed in the tritium facilities.

**Y-12 National Security Complex, Highly Enriched Uranium Materials Facility.** The Highly Enriched Uranium Materials Facility is the nation's central repository for highly enriched uranium. It commenced operations in January 2010. The Board provided extensive oversight of startup activities and has continued to evaluate the safety of the facility's operations. On April 20, 2011, the Board sent a letter to NNSA challenging changes that had been made to the documented safety analysis. In particular, the Board disagreed with removing the analysis of chemical and toxicological hazards from the safety basis and was concerned that NNSA's Y-12 site office had directed the contractor to evaluate downgrading some or all important fire safety measures, including the secondary confinement system for the facility.



**HEUMF at the Y-12 National Security Complex**

In response to the Board's letter, NNSA directed the Y-12 contractor to ensure all hazards are evaluated and controlled and to provide a more detailed analysis for fire accident scenarios. This analysis will provide a basis to evaluate the necessity of maintaining safety measures for the facility.

### **Y-12 Conduct of Operations and Work Planning**

The Y-12 National Security Complex is essential to the safe, secure, and reliable management of the nuclear weapons stockpile. Operators at Y-12 receive and store enriched uranium and manufacture, disassemble, and inspect nuclear weapon components. The Board provides safety oversight for these activities.

Since 2007, contractor personnel at Y-12 have performed an annual assessment of the adequacy of the aging 9212 Complex to support continued safe operations. Some infrastructure improvements have been made. During 2010, contractor managers self-reported several operational events and weaknesses in work planning and conduct of operations. In 2011, the Board also documented instances of inadequacies in procedures and poorly implemented work processes.

In a letter to NNSA dated August 25, 2011, the Board identified several weaknesses related to the safe performance of work at Y-12. In particular:

- workers lacked rigor during execution of procedures and work packages,
- in some instances, operators did not follow procedures as written, and
- poor procedure quality hindered the safe performance of work.

In another letter to NNSA dated December 29, 2011, the Board identified instances in which the site's work planning relied on generic hazards and controls that did not cover the planned work activity. Consequently, the fundamental objectives of activity-level work planning were not being met.

In response to the Board's concerns, contractor personnel developed corrective actions for the observed weaknesses. These actions include (1) requiring a more rigorous approach to executing procedures, (2) developing hands-on training for workers to reinforce proper conduct of operations, (3) augmenting and integrating oversight and assessment programs, and (4) replacing generic analyses and controls with hazard analyses and controls specific to the tasks being performed.

## VII. Design and Construction

### New Facilities

The Atomic Energy Act requires that the Board review the design and construction of new defense nuclear facilities to ensure that eventual operation of these facilities will be safe for workers and the public. The Board uses a variety of methods to carry out this function, including detailed reviews by the Board’s technical staff, public hearings, requests for information, and visits by Board members to construction sites. Currently the Board is actively overseeing the design and construction of 10 new defense nuclear facilities with a projected total cost of approximately \$25 billion dollars. The Board is waiting to see what action DOE takes on several other projects that are on hold or have been deferred. The table below lists DOE’s design and construction projects, the status of each project, and the status of the Board’s review. All documents referenced in the text below are publicly available and may be accessed on the Board’s website at <http://www.dnfsb.gov>.

**Design and Construction Projects Under Review**

<b>Project Name</b>	<b>Location</b>	<b>Projected Cost</b>	<b>Status of Project</b>	<b>Status of Board Review</b>
Waste Treatment and Immobilization Plant	Hanford Site, Richland, WA	\$12.3 billion	Concurrent design and construction	Ongoing
K-Basin Closure Sludge Treatment Project	Hanford Site, Richland, WA	\$268 million	Phase 1: Preliminary design Phase 2: Conceptual design	Ongoing – most recent Board letter dated December 22, 2010
Integrated Waste Treatment Unit	Idaho National Laboratory, ID	\$571 million	Construction complete, conducting performance testing	Ongoing – no current safety issues
Chemistry and Metallurgy Research Replacement Project	Los Alamos National Laboratory, NM	\$3.7–5.8 billion (Under DOE review)	Final design	Ongoing
Radioactive Liquid Waste Treatment Facility Upgrade Project	Los Alamos National Laboratory, NM	Under evaluation	Preliminary design	Ongoing – no current safety issues

**Design and Construction Projects Under Review (cont.)**

Transuranic Waste Facility Project	Los Alamos National Laboratory, NM	\$71–124 million	Final design	Ongoing
Pit Disassembly and Conversion Project	Savannah River Site, Aiken, SC	Under evaluation	Major change in conceptual design pending	On hold awaiting DOE project decisions
Salt Waste Processing Facility	Savannah River Site, Aiken, SC	\$1.34 billion	Construction	Ongoing – several open safety issues
Waste Solidification Building	Savannah River Site, Aiken, SC	\$345 million	Construction	Ongoing – no current safety issues
Uranium Processing Facility	Y-12 Complex, Oak Ridge, TN	\$4.2–6.5 billion (Under DOE review)	Final design	Ongoing

Detailed information on three of the most costly and potentially most hazardous facilities under examination is provided below.

**Hanford Site, Waste Treatment and Immobilization Plant**

The Waste Treatment and Immobilization Plant (sometimes referred to as the Waste Treatment Plant) is a \$12 billion radiochemical processing facility. DOE began work on this project in the late 1990s. Its purpose is to treat 56 million gallons of radioactive and toxic waste stored in 177 underground tanks on the Hanford site near Richland, Washington. After these wastes are retrieved from the tanks, the plant will chemically separate the waste into two streams of differing radioactive hazard and solidify them into glass in stainless steel canisters. The low-radioactivity glass will be disposed of onsite, while the high-level waste glass will be shipped offsite for permanent disposal once a repository is available. The plant will use three primary nuclear facilities known as the Pretreatment, Low-Activity Waste, and High-Level Waste Facilities to meet these objectives. DOE’s principal design and construction contractor is Bechtel National, Inc., a business unit of the Bechtel Corporation.

For more than a decade, the Board has devoted time and resources to oversight of this critical facility with two main safety objectives. First, operation of the plant must not expose the public or workers to undue risk. Second, the plant must achieve its design objectives to

eliminate the safety and environmental risks posed by continued storage of this waste in aging underground tanks. Although this is a one-of-a-kind project with novel technology that requires significant research and development, it is being designed concurrent with construction. As a result, timely identification and resolution of technical issues is paramount to meeting the objectives of the Hanford cleanup effort.



**Construction Site, Waste Treatment and Immobilization Plant**

The Board's safety reviews have focused on ensuring that important safety systems can meet the safety function and safety performance requirements in the project safety basis documents. During the past year, the Board identified weaknesses in the design of safety systems and is working closely with DOE to correct them.

- **Mixing in Process Vessels.** On December 17, 2010, the Board issued Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*, to address nuclear safety hazards arising from inadequate mixing of waste in processing tanks. DOE's initial response on February 10, 2011, was not a clear acceptance. The Board reaffirmed its recommendation and requested that the Secretary of Energy provide the Board with a final decision on whether DOE would implement all or part of the recommendation. DOE notified the Board on June 20, 2011, that it would accept the recommendation in its entirety. DOE provided the Board with its implementation plan on November 10, 2011. The Board evaluated the plan and concluded that it was adequate to solve the problems identified by the Board. DOE plans to conduct a test program to determine the capabilities of the plant's mixing systems, develop waste acceptance criteria for the plant that will address safety concerns associated with

mixing, and determine the requirements for waste sampling systems in the Tank Farms and the plant.

- **Use of Low Order Accumulation Model.** In 2011, the Board expressed its belief that a software model being used by the project contractor to assess the performance of mixing systems was not suitable for predicting the accumulation of solids in process vessels. The model will consistently under-predict the accumulation of solids and has no sound physical basis. DOE informed the Board that the model will not be used for further design work. DOE's contractor is developing a revised approach to validating vessel design as a result of the Board's findings.
- **Hydrogen in Piping and Ancillary Vessels.** DOE's contractor continues to pursue using quantitative risk assessment to design piping and ancillary vessels that have the potential for hydrogen explosions. The contractor recently completed its resolution of technical concerns previously identified by the Board and by an independent review team chartered by DOE. However, the contractor has not yet implemented the revised hydrogen control strategy in the plant's design or safety basis. It also needs to complete a major testing effort to determine the effect of hydrogen explosions on components such as valves and instrumentation.
- **Spray Leak Analysis.** In 2011, the Board challenged the contractor's technical approach for determining the consequences of accidents involving sprays of radioactive liquids. DOE acknowledged that the Board's concerns were valid and committed to resolve them through a test program. DOE anticipates receiving test results in early 2012.
- **Aerosol Deposition Velocity.** Deposition velocity is an important parameter used to calculate consequences of accidents that release radioactive material. The Board determined that DOE's choice of a value for deposition velocity could not be technically justified. DOE agreed with the Board's position. DOE's contractor is now using suitable values for this parameter. As a further result of the Board's actions, DOE has issued a revised policy on deposition velocity that is conservative and encourages the use of site-specific values.
- **Heat Transfer Analyses for Process Vessels in the Pretreatment Facility.** The Board found that the contractor's heat transfer analyses do not support a change in safety requirements pertaining to hydrogen gas. DOE plans to better justify technical assumptions in the contractor's heat transfer model.
- **Instrumentation and Control.** The Board questioned the contractor's interpretation of reliability requirements for the design of instrumentation and control systems at the Low-Activity Waste Facility. DOE committed to use alternative methods to re-evaluate the reliability of these systems. The Board believes the approach identified by DOE and its contractor to address this issue is acceptable.

- **Ammonia Hazards.** The Board found inadequate the design features proposed to protect workers from release of large quantities of ammonia stored at the plant. DOE stated that the contractor would reassess the design of these systems.

Further technical information on the Board's involvement in the Waste Treatment and Immobilization Plant may be reviewed in the following documents that can be found on the Board's website at <http://www.dnfsb.gov>:

- **Mixing in Process Vessels.** Board Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*; DOE Implementation Plan dated November 10, 2011.
- **Use of Low Order Accumulation Model.** Board letter dated June 7, 2011; DOE response dated August 5, 2011.
- **Hydrogen in Piping and Ancillary Vessels.** Periodic reports to Congress on the status of significant unresolved technical differences between the Board and DOE on issues concerning the design and construction of DOE's defense nuclear facilities, dated December 30, 2010, June 15, 2011, and September 23, 2011.
- **Spray Leak Analysis.** Board letter dated April 5, 2011; DOE response dated June 3, 2011.
- **Aerosol Deposition Velocity.** Board letters dated May 21, 2010, and August 26, 2010; DOE response dated November 5, 2010.
- **Heat Transfer Analysis for Process Vessels in the Pretreatment Facility.** Board letter dated August 3, 2011; DOE response dated November 16, 2011.
- **Instrumentation and Control.** Board letter dated May 5, 2011; DOE response dated July 1, 2011.
- **Ammonia Controls.** Board letter dated September 13, 2011; DOE response dated November 16, 2011.

### **Y-12 National Security Complex, Uranium Processing Facility**

Maintaining the United States' nuclear weapons stockpile requires the capability to handle and process highly-enriched uranium. These operations have been conducted primarily at the Y-12 National Security Complex in Oak Ridge, Tennessee. Many of the existing facilities at this site are decades old and overdue for replacement in the interest of efficiency and safety. When completed, the new Uranium Processing Facility will encompass approximately 350,000 square feet and employ improved technologies for these hazardous operations.



**Artist's Concept, Uranium Processing Facility**

In late 2010 and early 2011, the Board reviewed the facility's preliminary design, finding that it significantly reduced safety systems from those originally planned. The Board determined that satisfactory justification for this reduction had not been developed. NNSA reached the same conclusion, and in February 2011 directed its contractor to develop a more complete analysis in the form of a full Preliminary Safety Design Report. The Board reviewed this report in the fall of 2011. Once again, the Board identified serious flaws in the analysis. Once again, NNSA agreed and directed the contractor to take corrective actions. At the end of the year, NNSA was evaluating additional actions needed to ensure that the safety control set is adequate.

### **Los Alamos National Laboratory, Chemistry and Metallurgy Research Replacement Project**

The Chemistry and Metallurgy Research Replacement Project at Los Alamos involves construction of a 270,000 square foot structure to be used for storage of fissionable materials and for analytical operations supporting the nuclear weapons arsenal. Like the Uranium Processing Facility discussed above, it will replace a decades-old facility that lacks modern safety features.

The National Defense Authorization Act for Fiscal Year 2009 contained language requiring the Board to certify the adequacy of the safety and seismic design of the facility. The Board issued the required certification report in September 2009. The Board's oversight in the past year has focused on full implementation of design commitments made by NNSA pursuant to the certification review. Enhanced preliminary design continued throughout 2011, including revisions to the preliminary documented safety analysis, process hazard analysis, and system design descriptions. The project slowed this year while NNSA addressed citizen concerns with its National Environmental Policy Act documentation. NNSA completed a supplemental

environmental impact statement and issued an Amended Record of Decision on October 11, 2011. On October 13, 2011, NNSA directed the project to proceed with final design.



**Conceptual Drawing of Chemistry and Metallurgy Research Replacement Facility**

The certification effort and ongoing Board reviews have provided assurance that safety is being properly integrated into the design. The current schedule calls for the project to request Critical Decision 3A, Long-Lead Equipment Fabrication, no sooner than fiscal year 2013. Prior to that time, the Board will review the updated preliminary documented safety analysis and other safety documentation. The Board will continue to focus its review on the facility's ability to withstand the design basis earthquake and the adequacy of the facility's ventilation system to confine radioactive materials in accidents.

## VIII. Hazardous Materials

The Board is responsible for ensuring that DOE safely processes, stabilizes, and disposes of hazardous nuclear materials. The Board's safety oversight focuses on DOE's management of defense-related high-level waste, processing of nuclear materials into stable forms for safe long-term storage or disposal, and deactivation and decommissioning of defense nuclear facilities that are no longer needed.

### High-Level Waste Management

DOE manages high-level defense waste at the Hanford, Savannah River, and Idaho National Laboratory sites. The Board has focused operational oversight on the large tank farms at Hanford and Savannah River sites. In 2012, the Board will expand this effort to include startup and operation of the Integrated Waste Treatment Unit at the Idaho site. This facility will process sodium-bearing waste currently stored in three underground tanks.

- **Conduct of Operations at Hanford Tank Farms.** The Board reviewed the conduct of operations at the Tank Farms and determined that DOE needed to improve (1) the quality and level of detail of work instructions and technical procedures, (2) adherence by workers to written steps, and (3) review and control of work by the supervisors at the worksite. DOE took corrective action in response to the Board's March 30, 2011, letter on the subject.
- **High-Level Waste Transfer System at Hanford.** The Board reviewed the systems used to prevent leaks and spills during waste transfer operations at the Tank Farms. In a letter dated April 26, 2011, the Board found weaknesses in the qualification, performance, and maintenance of the waste transfer system and deficiencies in the associated safety basis. The Board is working with DOE to correct these deficiencies.
- **Structural Integrity of Hanford High-Level Waste Tank C-105.** In response to a stakeholder's concern, the Board evaluated whether the Tank Farm contractor had damaged the footing of Tank C-105 while drilling a borehole to sample the soil outside the tank. The Board concluded that the drilling rig would not have imparted sufficient energy to damage the tank, but advised DOE that it should expeditiously remove the remaining waste from the tank if radionuclide concentrations in the soil start to increase significantly. The Board provided a written response to the stakeholder on June 9, 2011.
- **Hanford High-Level Waste Tank Ventilation.** The high-level wastes in Hanford's double-shell tanks generate flammable gases such as hydrogen. The tank ventilation systems serve an important safety function in limiting the accumulation of flammable gas to help prevent explosions. The Board determined that a DOE decision to downgrade the safety importance of this protective feature was in error and detailed its reasoning in a letter to DOE on August 5, 2010. During 2011, the Board worked with DOE to ensure prompt



**Hanford Double-Shell Tank Farm**

action is taken to restore the safety classification of the ventilation systems and identify needed physical improvements.

- **Savannah River Spent Fuel Storage.** The Board began in 2011 to assess the safety of spent nuclear fuel stored underwater in L Basin at the Savannah River Site. As discussed below, DOE has not defined an ultimate disposition path for much of this fuel, and fuel storage time may increase dramatically. After inquiries by the Board, DOE is planning to expand surveillances of the spent nuclear fuel to examine the extent of fuel damage and determine remedial actions.
- **Hanford Waste Encapsulation and Storage Facility.** This facility stores 1,936 cesium and strontium capsules in water-filled pool cells, representing about one-third of the total radioactivity of Hanford wastes. The Board reviewed maintenance practices at the facility and identified numerous deficiencies. The facility contractor is using the Board's findings along with its own assessment to complete a formal causal analysis for the overall weakness in the quality and use of technical procedures. The contractor will use the causal analysis to develop corrective actions.

On December 7, 2011, Board closed Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*, which had caused DOE to address the critical shortage of tank space in the high-level waste system. Because of the shortage of storage space, DOE made operational decisions with undesirable safety and schedule impacts. Once DOE addressed the immediate issue of leaks in an old-style tank, further corrective actions focused on improving the operability of the site's high-level waste evaporators, selecting and developing processing capabilities for the liquids and saltcake in the tanks, and improving other aspects of waste management. The Board will track the actions associated with the remaining open commitments in the implementation plan for Recommendation 2001-1 using its normal oversight processes.

## Nuclear Materials Stabilization

DOE dramatically changed its plans for stabilization of surplus nuclear materials. At the beginning of 2011, citing budget and policy uncertainties, DOE directed a contractor at the Savannah River Site to cease preparations for plutonium processing and begin flushing H-Canyon process equipment. This direction left the fate of the spent nuclear fuel and other nuclear materials at Savannah River in question. The Board sent a letter to the Secretary of Energy on February 28, 2011, outlining safety concerns associated with this decision. DOE responded by providing new disposition paths for a significant portion of the nuclear materials but has not developed a new strategy for spent nuclear fuel. In the Board's public hearing at the Savannah River Site on June 17, 2011, the Board obtained commitments from DOE to develop a resumption plan for H-Canyon in addition to performing emergency drills for seismic events that could impact multiple nuclear facilities. Depending on DOE's progress, the Board may need to take further action.

Electrical safety at H-Canyon has been improved by design and installation of a lightning protection system, an action requested by the Board in its February 6, 2009, letter. This upgrade will protect the availability of the facility's safety systems during thunderstorms, which are frequent at this site.

At the Hanford site, the Board reviewed DOE's plans to restart operations at the Cold Vacuum Drying Facility. This facility will support cleanup of the K West Basin as well as sludge disposition. The Board suggested that DOE reconsider the planned level of rigor for restarting this facility based on how long it has been inactive. DOE now plans to conduct a formal readiness assessment to better ensure the facility is ready to operate safely. In addition, the Board reviewed DOE's conceptual design for systems to remove radioactive sludge from the K West Basin. This review disclosed several design problems that were identified in a letter to DOE dated December 22, 2010. In response, DOE is enhancing safety systems, improving the accident analysis, and developing a new capability to evacuate members of the public from the Columbia River in the event of an accident.



**Mock-up of Sludge Container**

## Transuranic Waste Remediation and Disposal

The Board reviewed transuranic waste remediation operations at DOE's Idaho and Savannah River sites, and transuranic waste disposal at the Waste Isolation Pilot Plant in New Mexico. The Board found procedural compliance issues at Idaho, leading DOE and its contractor to take corrective actions. The Board also evaluated preparations for the retrieval of degraded waste boxes and drums at the Advanced Mixed Waste Treatment Project at Idaho. The Board identified problems with the contractor's implementation of safety controls, which were corrected during prestart activities for the retrieval work.



**Underground, Waste Isolation Pilot Plant**

At the Savannah River Site, the Board reviewed the startup of new phases of transuranic waste remediation operations in E-Area, F-Canyon, and H-Canyon. The Board found that during F-Canyon's preparations for operation, operators and shift operations managers did not understand topics such as safety basis requirements. DOE conducted remedial training for the affected personnel.

Transuranic waste cleanup is becoming increasingly hazardous and challenging as the effort progresses. Many of the containers remaining to be addressed are in poor condition and contain much higher quantities of radioactive and hazardous materials than containers already processed. Greater worker protection will be required during cleanup. Incidents that resulted in plutonium uptakes by workers at Idaho and Savannah River serve as important lessons learned.



**Waste Retrieval at the Advanced Mixed Waste Treatment Project**

The Waste Isolation Pilot Plant is the nation's sole facility for permanent disposal of defense-related transuranic waste. As a result of the Board's efforts, DOE took actions in 2011 to improve the safety of these activities, as summarized below.

- **Fire Protection.** The Board reviewed the fire protection program at the site and, in a letter dated June 24, 2011, noted a number of deficiencies. DOE acknowledged these problems and agreed to take corrective action.
- **Electrical Safety.** The Board visited the site in March 2011 and reviewed DOE progress on corrective actions for electrical safety issues that the Board had noted previously. DOE completed all the needed actions by the end of 2011.
- **Radiation Protection Program.** In 2010, the Board noted weaknesses in the requalification process for radiological control technicians. DOE subsequently revised the process to correct the weaknesses. The Board confirmed that the revised process was implemented and effective during a visit to the site in March 2011.

### **Deactivation and Decommissioning**

Part of the Board's statutory task is to ensure that defense nuclear facilities are safely deactivated and decommissioned. Key Board efforts in this area include evaluating activity-level hazard analyses and work planning and control programs that are central to the safe performance of this type of work. In 2011, the Board followed up on past findings of weakness in these programs for the Hanford Plateau Remediation contractor and Hanford's River Corridor Project. The Board evaluated improvements being piloted by the Plateau Remediation contractor, and later performed a follow-up review of the River Corridor Project that found significant progress had been made.

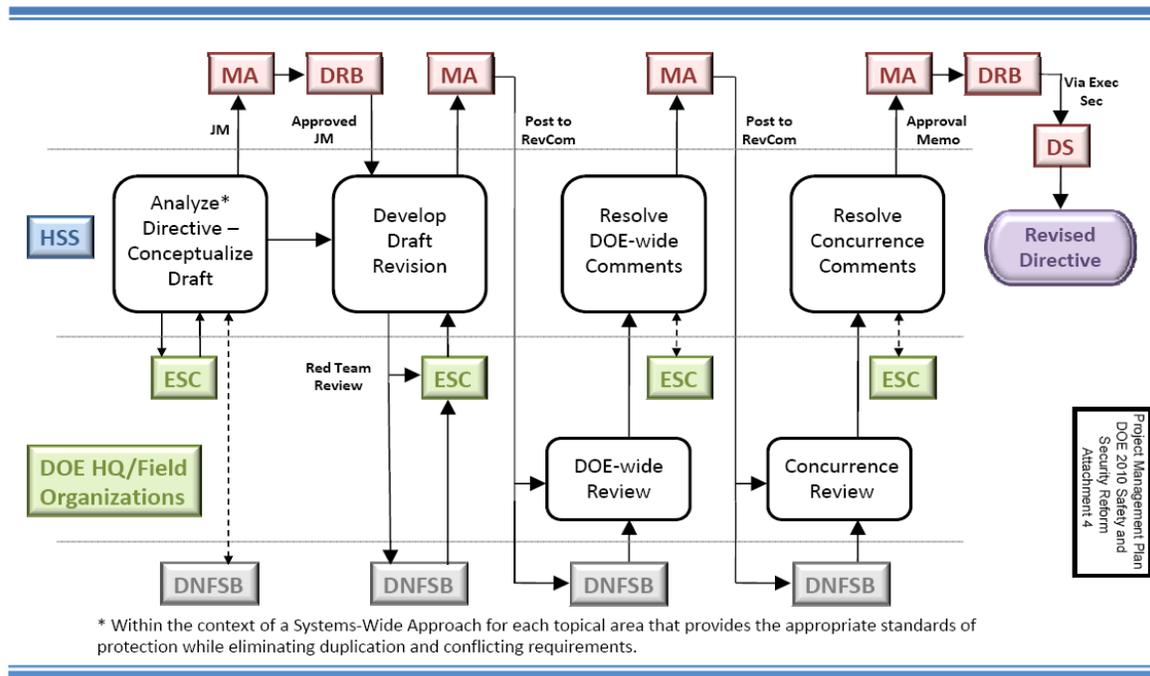
At the end of 2010, the Board reviewed the safety basis and radiological controls for a unique project at Oak Ridge National Laboratory to excavate and remove a highly contaminated underground vessel, Tank W-1A. The Board found significant problems, leading DOE to strengthen the safety basis for the work and improve the procedures for the operation during 2011. The Board observed readiness preparations using the improved procedures in 2011, and work successfully began toward the end of the year.

## IX. Safety Standards and Programs

### Department of Energy Directives

The Atomic Energy Act requires the Board to evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities. "Standards" in this context includes DOE orders, regulations, and guidance documents. In 2011, the Board reviewed and commented on DOE directives undergoing revision as part of DOE's "2010 Safety and Security Reform Plan," which commenced on March 16, 2010, and continued through 2011. As a result of this reform effort and the normal review process for technical standards and NNSA supplemental directives, the Board evaluated more than 40 DOE directives in 2011. The diagram below (prepared by DOE) illustrates the procedure used by the Office of Health, Safety and Security for revising directives.

### HSS Directives Process (for Revised Directives)



The Board provided constructive comments on directives being developed or revised, and evaluated the safety impact for directives that DOE proposed to cancel. Examples of safety-related directives that the Board completed reviewing in 2011 are listed in the table on the next page.

### Sample of Directives Reviewed in 2011

Directive Number	Title	Role in Safety Assurance
DOE Order 227.1	Independent Oversight Program	Provides requirements and responsibilities for the DOE Independent Oversight Program, which is integral to assuring the adequacy of DOE policies and requirements and the effectiveness of DOE and contractor line management safety performance
DOE Order 232.2	Occurrence Reporting and Processing of Operations Information	Promotes organizational learning and ensures that DOE is informed about events that could affect the health and safety of the public and workers
DOE Order 426.1 Change 1	Federal Technical Capability	Defines requirements and responsibilities for recruiting, deploying, developing, and retaining a technically competent workforce that will accomplish DOE missions in a safe and efficient manner
DOE Guide 433.1-1A	Nuclear Facility Maintenance Management Program Guide for Use with DOE O (Order) 433.1B	Provides acceptable approaches for implementing requirements for Nuclear Maintenance Management Programs set forth in DOE Order 433.1B, <i>Maintenance Management Program for DOE Nuclear Facilities</i>
DOE Guide 450.4-1C	Integrated Safety Management System Guide	Provides DOE line management with guidance for effectively and efficiently implementing the DOE policy and order on integrated safety management, and provides DOE contractors with guidance for effectively and efficiently implementing the integrated safety management requirements specified by the Department of Energy Acquisition Regulation

At year's end, the Board was in the process of resolving issues regarding 13 directives. These directives include draft DOE Order 420.1C, *Facility Safety*; draft DOE Guide 420.1-1A, *Nonreactor Nuclear Safety Design Criteria and Guide for use with DOE O 420.1C, Facility Safety*; draft DOE Standard 1066, *Fire Protection*; draft DOE Standard 1020, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*; draft DOE Standard 1212, *Explosives Safety*; and draft DOE Guide 226.1-2, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*.

## Review of Nuclear Safety Programs

In conducting oversight of DOE's nuclear safety programs, the Board applies a complex-wide perspective that builds on data collected at the field level, integrating the results to identify opportunities for broad safety program improvements. The Board dedicates significant resources to reviewing safety analyses and controls at defense nuclear facilities; key supporting programs such as quality assurance, nuclear criticality safety, and training and qualification of personnel; the technical competence of DOE's federal workforce; DOE's safety oversight of its contractors; and other attributes important to nuclear safety. These efforts led to significant safety improvements. Highlights are summarized below:

**Integrated Safety Management.** The Board reviewed the implementation of integrated safety management<sup>7</sup> in work planning at Washington Closure Hanford, the Nevada National Security Site, and the Y-12 National Security Complex. In all cases, the Board found weaknesses in the analysis of hazards and development of controls to ensure worker safety. In response, DOE's contractor URS Global Management and Operations Services developed a work planning standard that is now implemented at five DOE defense nuclear facilities. The Energy Facility Contractors Group is tailoring the URS standard to use at all DOE defense nuclear facilities.

Similarly, the Board reviewed implementation of integrated safety management in conduct of operations and maintenance at three Hanford facilities, the Idaho National Laboratory, and the Y-12 National Security Complex. The Board noted weaknesses in the quality and use of technical procedures, supervisory control of work activities, and execution of work. The Board formally communicated its concerns regarding Hanford and Y-12 and will continue to evaluate DOE's efforts to improve conduct of operations throughout the complex.

**Governance and Oversight.** The Board held a public hearing on May 25, 2011, to review DOE's safety management and oversight of the contracts and contractors they rely upon to accomplish the mission at defense nuclear facilities. The Board focused on the impact of DOE and NNSA governance reform initiatives on assuring adequate protection of the health and safety of the public and workers at defense nuclear facilities. The public hearing heightened the awareness of senior DOE and NNSA leadership of the need to maintain safety management and oversight systems for defense nuclear facilities. Senior DOE and NNSA leadership confirmed their ongoing support for and commitment to integrated safety management and shared their vision for oversight across the DOE complex.

The Board evaluated reviews conducted by NNSA to affirm the line oversight and contractor assurance systems at the Y-12 National Security Complex in Tennessee and at the Sandia National Laboratories in Albuquerque, New Mexico. The Board provided direct feedback on problems with the performance and logistics of these reviews to the affirmation team

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<sup>7</sup> Integrated safety management is the process by which DOE and its contractors integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment.

leaders. The Board found that the review at Y-12 did not delve into sufficient detail to assess the effectiveness of either line oversight or the contractor assurance system, and that the review at Sandia was premature based on the contractor's own assessment that its implementation was incomplete. NNSA used this feedback to improve the affirmation review process to be applied to the remaining sites.

**Safety System Design, Functionality, and Maintenance.** The Board continued to conduct reviews of safety system design, functionality, and maintenance at defense nuclear facilities. In 2011, such reviews were undertaken at the Tritium Facility and Plutonium Facility at Lawrence Livermore National Laboratory and at the Hanford Tank Farms. A number of important safety issues were identified during these reviews and communicated to DOE for resolution. DOE has agreed to upgrade the safety classification of several engineered systems to better ensure the systems will perform required safety functions, and is presently evaluating the Board's findings regarding the Lawrence Livermore Plutonium Facility (letter to NNSA dated December 13, 2011).

**Nuclear Criticality Safety.** The Board reviewed nuclear criticality safety evaluations from several sites, including the Nevada National Security Site, Los Alamos National Laboratory, Y-12, Savannah River Site, and Hanford. The Board also reviewed the technical basis for not requiring a criticality accident alarm system at Device Assembly Facility at the Nevada National Security Site. Each of these reviews confirmed that the various criticality safety programs and associated documentation were adequate, but the Board noted several opportunities for improvement and communicated them to DOE and its contractors.

**Quality Assurance.** The Board reviewed DOE's revised directive on quality assurance. The revised order is stronger and clearer than the previous version. The Board conducted five reviews in 2011 and provided timely feedback to DOE as it strives to improve awareness and performance in commercial grade dedication, suspect/counterfeit items, software quality assurance, and quality assurance programs.

## **X. Investigations**

The Board completed and closed one formal investigation in 2011. As a result of this investigation, the Board issued Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*, described in Section III above. In this section we will describe briefly the Board's investigative power and the need for confidentiality of the investigative record.

### **The Board's Statutory Authority to Investigate**

Section 2286a(a)(2) of the Atomic Energy Act sets forth the Board's investigative function and powers. This provision reads in full:

- (A) The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.
- (B) The purpose of any Board investigation under subparagraph (A) shall be—
  - (i) to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;
  - (ii) to ascertain information concerning the circumstances of such event or practice and its implications for such standards;
  - (iii) to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and
  - (iv) to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.

This provision contains several key features. Paragraph (A) *mandates* an investigation when the requisite conditions are met. The conditions are broad and discretionary: the Board determines when an investigation is needed, and the Board must investigate an event or practice that “may” adversely affect public health and safety. The investigative power is not conditioned on the consent of DOE. The purpose of a Board investigation is to identify such changes in DOE standards or their implementation “as may be prudent or necessary” to ensure adequate protection of the public health and safety.

### **Confidentiality of the Investigative Record**

In Recommendation 2011-1, the Board disclosed as much of the investigative record in this proceeding as was consistent with protecting the identity of witnesses and their testimony. Nothing further will be disclosed. DOE initially pressed the Board to allow it unfettered access

to this record. In a letter to the Chairman dated June 22, 2011, the Deputy Secretary of Energy requested access to the Board's investigative files in order to respond to the recommendation. The Board declined to grant this request in a letter to the Secretary of Energy dated June 30, 2011:

Since the Board began operation, confidentiality of communications from concerned employees or the public, coupled with expert technical integrity has served both the Board and DOE to ensure adequate protection of public health and safety and appropriate resolution of public health and safety concerns. Therefore, the Board declines the Deputy Secretary's request for access to the Board's investigative files.

In the ordinary course of business, the Board and its staff request information from DOE and its contractors and use this information freely in documents made available to the public, subject to national security restrictions or other privileges. When a formal investigation is undertaken, however, individuals may provide information to the Board at considerable personal risk. The Board assures these persons that their identity and testimony will not be released under any circumstances. The promise of confidentiality, used by many law enforcement and regulatory agencies, is an invaluable tool in uncovering safety issues that would never be discovered by the usual process. Federal courts have recognized and accepted this evidentiary privilege.<sup>8</sup>

The Board regards as essential to its investigatory power the ability to protect the identity of witnesses and the confidentiality of the investigative record. Any person coming to the Board with information relevant to the Board's mission must feel protected from retaliation, however subtle or disguised. Only in this way can the Board obtain safety information needed to thoroughly evaluate potential hazards at defense nuclear facilities.

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<sup>8</sup> See, for example, *Machin v. Zuckert*, 316 F.2d 336 (D.C. Cir. 1963), and *United States v. Weber Aircraft Corp.*, 465 U.S. 792 (1984).

## XI. Informing the Public

### Public Hearings

The Board's enabling legislation vests it with a comprehensive suite of statutory tools to accomplish its oversight mission. Chief among these is the Board's power to hold public hearings. Public hearings are essential to the Board's mission because they assist the Board in obtaining vital safety information from the DOE, NNSA, expert sources, and the public. In 2011, the Board made full and extensive use of this statutory tool, holding three public hearings. The Federal Register notice and agenda for each hearing were posted on the Board's website, and the Board advertised hearings held away from Washington, D.C., in local newspapers. The Board receives testimony from the public at its hearings. Such testimony is included in the public record of the hearing.



**Public Hearing in Santa Fe, NM, November 2011**

**May 25, 2011.** The Board held the third in a series of public hearings to review DOE's implementation of Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*. The Board convened the hearing at its Washington, D.C., headquarters. This hearing evaluated what impact the changes in DOE's and NNSA's organizational structure and practices, particularly those related to safety oversight, directives, and governance could have on assuring adequate protection of public and worker health and safety at DOE and NNSA defense nuclear facilities. The Board also offered a live webcast stream of this hearing on its website. Members of the public wishing to inspect the transcript of the hearing may do so by visiting the Board's public reading room. A DVD of the hearing is also available upon request.

**June 16, 2011.** The Board held a public hearing in Augusta, GA. The objective of this hearing was to further investigate matters affecting the health and safety of the public and the workers at the Savannah River Site, paying particular attention to high-level waste processing, emergency preparedness, and nuclear materials disposition. This hearing was broken down into two sessions. In Session I, the Board sought testimony on DOE’s plan for stabilizing high-level waste and reducing risk in the tank farms. Session I also focused on evaluating the disaster preparedness of DOE and contractor organizations at the site. In Session II, the Board assessed the efficacy of DOE’s disposition plan for nuclear materials in light of the possible termination of chemical processing at H-Canyon and HB-Line. The Board also received testimony on whether long-term storage of nuclear materials could adversely affect safety. The transcript of the hearing is available for examination in the Board’s public reading room. A DVD of the hearing is also available upon request.

**November 17, 2011.** The Board’s final hearing of 2011 was held in Santa Fe, NM. This hearing addressed issues affecting public and worker health and safety at Los Alamos National Laboratory. The hearing was divided into two sessions. In Session I, the Board heard testimony from NNSA on earthquake vulnerabilities at the laboratory’s Plutonium Facility, as well as NNSA’s emergency preparedness at the site. The Board sought to understand the safety basis for the Plutonium Facility and NNSA’s determination of “adequate protection” in light of very high offsite consequences following a postulated design-basis earthquake. The Board was particularly interested in NNSA’s disaster response plan and how the accident at the Fukushima nuclear reactor in Japan, the recent Las Conchas wildland fire, and the 2000 Cerro Grande wildland fire informed NNSA’s emergency preparedness at the site. In Session II, the Board assessed the public health and safety hazards posed by aging facilities at the laboratory and NNSA’s planned mitigation of such risks. This hearing was also made publicly available via a live video stream on the Board’s website. Members of the public may visit the Board’s public reading room to review the transcript of the hearing and view the DVD video recording of the hearing. A DVD of the hearing is also available upon request.

**Response to FOIA Requests**

The Board received 24 formal requests for Board records filed under the Freedom of Information Act (FOIA) in 2011. The average response time was 14 working days, as compared with the statutory requirement of 20 working days. The table below outlines how the Board responded to each request.

**Board Response to 2011 FOIA Requests**

<b>Board Response</b>	<b>Denial Based on Exemption</b>	<b>Partial Grant</b>	<b>Full Grant</b>	<b>No Records Located</b>	<b>Other</b>
<b>No. of Requests</b>	2	1	12	7	2

Executive Order 13392 mandates that federal agencies adopt a presumption of openness when processing FOIA requests. To reflect its acceptance of this presumption, the Board created a “FOIA Reading Room” page that is directly accessible from the Board’s homepage. The information available on the FOIA Reading Room page includes a running five-year log of FOIA requests received by the Board, frequently-requested information, the Board’s regulations implementing FOIA, the Board’s FOIA Annual Reports from 1998 to the present, and the name and contact information for submitting FOIA requests.

The Board also made it possible for the public to send FOIA requests directly to the FOIA Information Officer from the FOIA Reading Room web page. Ease of access to Board records was improved by adding more documents to the updated public website.

### **Public Website and Video Streaming**

In 2011, the Board completely redesigned its internet website to make the public the primary audience. The fundamental design goals for the Board’s new website were (1) clearer articulation of the Board’s mission and the work the Board performs to complete that mission, (2) expansion of the public’s access to Board records and deliberations, and (3) increased transparency of the Board’s operations.

To achieve these design goals, the Board:

- improved the graphical design and site layout to make the new website more visually appealing,
- added new sections, including *Who We Are*, *What We Do*, and *Where We Work*, to provide increased visibility into the Board’s mission and supporting activities,
- added new features, including *Announcements* and *Recent Board Activity*, to make it easier to find Board and DOE documents and correspondence, and
- improved the search engine to enable users to more quickly locate their desired information.

Since 2003, the Board has contracted with a third party for live video and audio streaming of hearings conducted at the Board’s Washington, D.C., headquarters. During a hearing, the Board posts a link on the Board’s homepage, which allows the public to view live broadcasts. At the close of the hearing, the Board posts an archived copy of the video on its website for on-demand viewing. The archived video is available for 60 days. To increase public participation in Board activities, the Board began contracting for live streaming services of all hearings, including those occurring off-site, when possible.

## Public Reading Room

The Board maintains a public reading room for the purpose of providing a quiet, citizen-centered space that offers accessibility to a substantial portion of the Board's records. The reading room is located at the Board's headquarters and is open to the public Monday through Friday from 8:00 a.m. to 4:30 p.m., with the exception of federal holidays. Knowledgeable staff members are on hand to assist visitors in finding documents, conducting computer searches of the Board's public electronic files, and studying the Board's library reference materials, which are restricted to the premises. The records available in the reading room for inspection and copying include Board regulations, technical reports, recommendations, transcripts of hearings, and reference copies of public documents provided to the Board by DOE.

Pursuant to the Board's enabling legislation, all of the Board's recommendations are mailed to DOE's Public Reading Room at DOE's headquarters building, located at 1000 Independence Avenue, SW, Washington, D.C. 20585.



**The Board's Public Reading Room**

## XII. Funding and Human Resources

### Budget Levels and Staffing

The Board's Congressional budget request for Fiscal Year (FY) 2011 was \$28.640 million. The Board's appropriation for FY 2011 was \$23.204 Million, an 11% reduction from the previous fiscal year and 19% below its FY 2011 request. By exhausting its carryover and instituting cost-cutting measures, including a hiring freeze, the Board was able to continue operations without reducing its staff in FY 2011. The Consolidated Appropriations Act of 2012 provided the Board \$29.130 million in new budget authority, which was the President's budget request.

The Board consisted of four Presidential appointees in 2011, one less than called for in the Board's enabling legislation. The Board continued to increase its workforce with the goal of reaching the 120 full-time-equivalent (FTE) level specified in its FY 2011 and FY 2012 Congressional budget requests. This number includes the goal of having 83 staff engineers. By the end of calendar year 2011, the Board had 77 engineers on board, reflecting the impact of the hiring freeze on the Board's recruiting effort. Total federal employee strength at the end of 2011 was 109.

In 2011, the Board achieved its sixth consecutive unqualified audit opinion on its financial statements from an independent auditor, as required by Accountability of Tax Dollars Act of 2002. The auditor found the Board complied with all applicable federal laws and regulations and had no material weaknesses in its internal controls.

The Board occupied second place among 35 small agencies in "The Best Places to Work in the Federal Government 2011" list published by the Partnership for Public Service. This ranking is based on data drawn from the Federal Employee Viewpoint Survey, conducted annually by the Office of Personnel Management.

<b>Rank</b>	<b>Agency</b>	<b>2011 Score</b>
1	<u>Surface Transportation Board</u>	91.1
2	<u>Defense Nuclear Facilities Safety Board</u>	89.3
3	<u>Federal Mediation and Conciliation Service</u>	81.4
4	<u>Peace Corps</u>	78.7
5	<u>Farm Credit Administration</u>	77.5
6	<u>Overseas Private Investment Corporation</u>	77.2
7	<u>Federal Labor Relations Authority</u>	76.3
8	<u>Commodity Futures Trading Commission</u>	75.2
9	<u>National Endowment for the Humanities</u>	74.7
10	<u>Federal Trade Commission</u>	74.3

## **Prioritization of Work**

The Board's safety oversight activities are prioritized predominantly on the basis of risk to the public and workers, types and quantities of nuclear and hazardous material at hand, and hazards of the operations involved. Four types of oversight are underway at all times.

- Evaluation of DOE's organizational policies and processes. These reviews evaluate topics such as technical competence of DOE and contractor personnel, adequacy of safety requirements and guidance, and the presence of a strong safety culture.
- Evaluation of actual hazardous activities and facilities in the field. These reviews focus on identifying the hazards and evaluating controls put in place to mitigate those hazards. The Board prioritizes these reviews based on the risk, complexity, maturity, and significance of the activities underway or planned by DOE.
- Expert-level reviews of the safety implications of DOE's actions, decisions, and analyses.
- Identification of new safety issues otherwise unknown in the DOE complex. Since, by definition, these safety issues would not have been addressed but for the Board's efforts, this may be the area in which the Board has the largest impact on the safety of DOE's highly hazardous operations.

The Board uses its Strategic Plan and its Annual Performance Plan to ensure that its resources remain focused on the most significant safety challenges. This approach gives the Board confidence that its staff and budget are dedicated to the highest risk activities under the Board's jurisdiction. Both of these plans may be viewed in their entirety on the Board's website.

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## **Appendix A: Recommendation 2011-1**

### **RECOMMENDATION 2011-1 TO THE SECRETARY OF ENERGY *Safety Culture at the Waste Treatment and Immobilization Plant* Pursuant to 42 U.S.C. § 2286a(a)(5) Atomic Energy Act of 1954, As Amended**

**Dated: June 09, 2011**

#### **Introduction**

Secretary of Energy Notice SEN-35-91, *Nuclear Safety Policy*, issued on September 9, 1991, and superseding policy statement #2 of DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*, issued on February 8, 2011, state that the Department of Energy (DOE) is committed to establishing and maintaining a strong safety culture at its nuclear facilities. The Defense Nuclear Facilities Safety Board (Board) has determined that the prevailing safety culture at the Waste Treatment and Immobilization Plant (WTP) is flawed and effectively defeats this Secretarial mandate. The Board's investigative record demonstrates that both DOE and contractor project management behaviors reinforce a subculture at WTP that deters the timely reporting, acknowledgement, and ultimate resolution of technical safety concerns.

#### **Background**

In a letter to the Secretary of Energy dated July 27, 2010, the Board stated that it would investigate the health and safety concerns at the WTP at Hanford raised in a letter to the Board dated July 16, 2010, from Dr. Walter Tamosaitis.

The Board's investigation focused on allegations raised by Dr. Tamosaitis, a contractor employee removed from his position at WTP, a construction project in Washington State funded by DOE and managed by Bechtel National, Incorporated (BNI). The Board's inquiry did not attempt to assess the validity of Dr. Tamosaitis's retaliation claim, but rather, as required by the Board's statute, examined whether his allegations of a failed safety culture at WTP, if proven true, might reveal events or practices adversely affecting safety in the design, construction, and operation of this defense nuclear facility.

The Board is required by statute to investigate any event or practice at a defense nuclear facility which it determines may adversely affect public health and safety. The Board conducted this investigation pursuant to its investigative power under 42 U.S.C. § 2286a(a)(2). During the course of the Board's inquiry, 45 witnesses were interviewed and more than 30,000 pages of documents were examined. The Principal Investigator was Joel R. Schapira, Deputy General Counsel, assisted by John G. Batherson, Associate General Counsel, and Richard E. Tontodonato, Deputy Technical Director. The record of the investigation is non-public and will be preserved in the Office of the General Counsel's files.

During the period of the investigation, the Board held a public hearing regarding safety issues at WTP. During that hearing the Board received additional information related to the kind of safety culture concerns raised by Dr. Tamosaitis. Consequently, the investigation was expanded to review these new concerns.

Secretary of Energy Notice SEN-35-91, *Nuclear Safety Policy*, issued on September 9, 1991, and superseding policy statement #2 of DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*, issued on February 8, 2011, state that DOE is committed to establishing and maintaining a strong safety culture at its nuclear facilities. The investigation's principal conclusion is that the prevailing safety culture at this project effectively defeats this Secretarial mandate. The investigative record demonstrates that both DOE and contractor project management behaviors reinforce a subculture at WTP that deters the timely reporting, acknowledgement, and ultimate resolution of technical safety concerns.

A key attribute of a healthy safety culture as identified by DOE's Energy Facility Contractors Group and endorsed by Deputy Secretary of Energy memorandum dated January 16, 2009, and in the Nuclear Regulatory Commission's proposed policy statement on safety culture (NRC-2010-0282, dated January 5, 2011), is that leaders demonstrate clear expectations and a commitment to safety in their decisions and behaviors. The Board's investigation found significant failures by both DOE and contractor management to implement their roles as advocates for a strong safety culture.

The record shows that the tension at the WTP project between organizations charged with technical issue resolution and development of safety basis scope, and those organizations charged with completing design and advancing construction, is unusually high. This unhealthy tension has rendered the WTP project's formal processes to resolve safety issues largely ineffective. DOE reviews and investigations have failed to recognize the significance of this fact. Consequently, neither DOE nor contractor management has taken effective remedial action to advance the Secretary's mandate to establish and maintain a strong safety culture at WTP.

Taken as a whole, the investigative record convinces the Board that the safety culture at WTP is in need of prompt, major improvement and that corrective actions will only be successful and enduring if championed by the Secretary of Energy. The successful completion of WTP's mission to remove and stabilize high-level waste from the tank farms is essential to protect the health and safety of the public and workers at Hanford. However, the flawed safety culture currently embedded in the project has a substantial probability of jeopardizing that mission.

## **Findings**

### **Finding One: A Chilled Atmosphere Adverse to Safety Exists**

In a letter to the Defense Nuclear Facilities Safety Board (Board) dated July 16, 2010,

Dr. Walter Tamosaitis, a former engineering manager at the Waste Treatment and Immobilization Plant (WTP), alleged that he was removed from the project because he identified certain technical issues that in his view could affect safety. Dr. Tamosaitis also alleged that there was a failed safety culture at WTP. With full understanding that the formal claims of retaliation raised by Dr. Tamosaitis would be looked into by others, the Board decided that his assertions raised serious questions about safety culture and safety management at WTP. From late July 2010 to May 2011, the Board reviewed a large number of documents and interviewed a substantial number of persons, including Dr. Tamosaitis, to assess whether or not his allegations of safety issues and of a faulty safety culture were borne out. The Board's investigation later expanded in scope to address matters related to the Board's October 2010 public hearing at Hanford on safety issues at WTP. This phase of the investigation consisted of closed hearings at which sworn testimony was elicited from DOE and contractor personnel.

The Board finds that the specific technical issues identified by Dr. Tamosaitis in his July 16, 2010, letter were known and tracked by the WTP project. In a WTP project managers' meeting on July 1, 2010, Dr. Tamosaitis raised safety concerns related to the adequacy of vessel mixing, technical justifications for closing mixing issues, and other open technical issues. The next day he was abruptly removed from the project. This sent a strong message to other WTP project employees that individuals who question current practices or provide alternative points of view are not considered team players and will be dealt with harshly.

The Board finds that expressions of technical dissent affecting safety at WTP, especially those affecting schedule or budget, were discouraged, if not opposed or rejected without review. Project management subtly, consistently, and effectively communicated to employees that differing professional opinions counter to decisions reached by management were not welcome and would not be dealt with on their merits. There is a firm belief among WTP project personnel that persisting in a dissenting argument can lead, as in the case of Dr. Tamosaitis, to the employee being removed from the project or reassigned to other duties. As of the writing of this finding, Dr. Tamosaitis sits in a basement cubicle in Richland with no meaningful work. His isolated physical placement by contractor management and the lack of meaningful work is seen by many as a constant reminder of what management will do to an employee who raises issues that might impact budget or schedule.

Other examples of a failed safety culture include:

- The Board heard testimony from several witnesses that raising safety issues that can add to project cost or delay schedule will hurt one's career and reduce one's participation on project teams.
- A high ranking safety expert on the project testified that the expert felt next in line for removal after Dr. Tamosaitis because of the expert's refusal to yield to technically unsound positions on matters affecting safety advanced by DOE and contractor managers responsible for design and construction at the WTP. This safety expert's concern was validated by a senior DOE official in separate sworn testimony.

- A report prepared by a subcontractor on the WTP project, “URS Report of Involvement in WTP Investigation,” discusses the “tension between organizations charged with technical issue resolution and development of safety basis related scope and those organizations charged with completing design and advancing construction. Some level of such tension is normal and healthy in projects of such scope and complexity; but at WTP, this tension is higher than what might be expected or desired. Some individuals whose personalities tend toward avoidance of conflict could view the organizational environment as not conducive to raising issues or perhaps even potentially suppressing some issues that might deter progress or that might add cost.”
- The investigative record shows that the DOE Office of River Protection Employee Concerns program is not effective. One safety expert explicitly testified that employees would not and did not use the program, and believed that individuals running the program would “bury issues” brought to them. The record shows that in the removal of Dr. Tamosaitis, Human Resources (HR) for URS was interested only in implementing management’s demand that the employee be removed immediately. The record shows HR did not assert any consideration or concern regarding the effect the process and manner of his removal would have on the remaining workforce and the effectiveness of the contractor employee protection program required under 10 CFR Part 708.
- An independent review of the WTP safety culture performed by DOE’s Office of Health, Safety and Security (HSS) found that “a number of individuals have lost confidence in management support for safety, believe there is a chilled environment that discourages reporting of safety concerns, and/or are concerned about retaliation for reporting safety concerns. These concerns are not isolated and warrant timely management attention, including additional efforts to determine the extent of the concerns.” Although the HSS report stated that most WTP personnel did not share these opinions, the Board notes that personnel interviewed by HSS were escorted to their interviews by management. The Board’s record shows that involving management with the interviews clearly can inhibit the willingness of employees to express concerns. In its own way, DOE’s decision to allow management to be involved in the HSS investigation raises concerns about safety culture.

This environment at WTP does not meet key attributes established by DOE’s Energy Facility Contractors Group, and endorsed by the Deputy Secretary of Energy, that describe a strong safety culture: DOE and contractor leadership must have a clear understanding of their commitment to safety; they are the leading advocates of safety and the public trust demands that they demonstrate their commitment in both word and action. The Board’s investigation concludes that the WTP project is not maintaining a safety conscious work environment where

personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.

### **Finding Two: DOE and Contractor Management Suppress Technical Dissent**

The HSS review of the safety culture on the WTP project “indicates that BNI has established and implemented generally effective, formal processes for identifying, documenting, and resolving nuclear safety, quality, and technical concerns and issues raised by employees and for managing complex technical issues.” However, the Board finds that these processes are infrequently used, not universally trusted by the WTP project staff, vulnerable to pressures caused by budget or schedule, and are therefore not effective. Previous independent reviews, contractor surveys, investigations, and other efforts by DOE and contractors demonstrate repeated, continuing identification of the same safety culture deficiencies without effective resolution.

Suppression of technical dissent is contrary to the principles that guide a high-reliability organization. It is essential that workers feel empowered to speak candidly without fear of retribution or criticism. In extreme cases, refusal to consider a different view of a safety issue can lead to catastrophic consequences. WTP is a complex and difficult project that is essential to the nation’s nuclear waste remediation program. Therefore, federal and contractor managers must make a special effort to foster a free and open atmosphere in which all competent opinions are judged on their technical merit, to sustain or improve worker and public safety first and foremost, and then evaluate potential impacts on cost and schedule.

One of the primary examples of suppressing technical information is a study that was performed by BNI in July 2009 on deposition velocity, a parameter used in modeling the offsite transport of radioactive particles for nuclear facility safety analyses. The study found that the correct value of the dry deposition velocity for Hanford fell in the range of 0.1 to 0.3 cm/sec. The Board’s investigation includes testimony by the former manager of DOE’s Office of River Protection and the DOE Chief of Nuclear Safety in Washington, D.C., that the results of this study were not shared with them. Consequently, DOE continued to follow its policy requiring the WTP project to use a less conservative default value of 1.0 cm/sec for dry deposition velocity. In the fall of 2010, the Chief of Nuclear Safety hired an independent consultant to investigate the issue. This consultant also found that deposition velocity fell in the range of 0.1 to 0.3 cm/sec, information that was already available to the project in the summer of 2009. Suppression of the 2009 study delayed the identification of properly conservative values for dry deposition velocity to use in the safety analyses that determine the need for safety-related controls for WTP facilities. Once this information was made available to DOE’s Office of Health, Safety and Security, a technical study ensued that determined the need for a more conservative value of deposition velocity to serve as a default value.

This problem also manifested itself when one of the expert witnesses, a nuclear safety professional, specifically asked by the Board to testify at the Board’s October 2010 public hearing on WTP safety issues, failed to support the DOE policy on the appropriate value for dry

deposition velocity. This witness testified that using DOE's prescribed default value for the dry deposition velocity in safety basis calculations could not be justified if it were known to be non-conservative for the Hanford Site. At the time of the hearing, the witness understood the correct value of deposition velocity was not being used in calculations of potential dose consequences to the public receptor and was unwilling to simply state the DOE position that a default value could be used or justified. The expert witness later testified for the record that DOE was fully aware of the July 2009 study on dry deposition velocity at the time of the public hearing. The expert witness' testimony during the public hearing clashed with the position taken by senior management in the DOE Office of River Protection and by the DOE Chief of Nuclear Safety.

The testimony of several witnesses confirms that the expert witness was verbally admonished by the highest level of DOE line management at DOE's debriefing meeting following this session of the hearing. Although testimony varies on the exact details of the verbal interchange, it is clear that strong hostility was expressed toward the expert witness whose testimony strayed from DOE management's policy while that individual was attempting to adhere to accepted professional standards. Testimony by a senior DOE official confirmed the validity of the expert witness' concerns. In addition, the expert witness testified that they felt pressure to change their testimony, but refused to do so.

Management behavior of this kind creates an atmosphere in which workers are reluctant to speak candidly for fear of retribution or criticism. Whether or not this behavior possibly violates federal law is not for the Board to determine; however, the Board does assert that fear of retribution visited on a competent professional for offering an honest opinion in a public hearing is incompatible with the objective of designing and building a safe and operationally sound nuclear facility and sustaining a healthy safety culture.

Another example of failure to act on technical information in a timely manner concerns a report related to the occurrence of a potential criticality event at WTP. In April 2010, the WTP project issued a plan of action to address recommendations of the WTP Criticality Safety Support Group, specifically, to review historical information on plutonium dioxide ( $\text{PuO}_2$ ) wastes discharged by the Plutonium Finishing Plant to the tank farms. The report of the review was completed and submitted to the WTP project in August 2010. A key finding of the report was that the maximum  $\text{PuO}_2$  particle size of 10 microns assumed in WTP criticality safety analyses was not conservative. Instead of receiving immediate attention, the report languished without action until February 2011.

Once the report was finally reviewed, the WTP project reached the initial conclusion that it may no longer be possible to assume that criticality in WTP is an incredible occurrence. (Based on this information, the Hanford Tank Farms operating contractor halted activities involving the affected tanks.) If criticality is confirmed to be credible, changes in the WTP criticality strategy will be required. This will result in changes to the existing safety basis and require an assessment of the existing WTP design to determine if design changes are required. Depending upon the magnitude of the criticality hazard, significant changes in the WTP design

may be necessary. DOE was not informed of this important finding in a timely manner, and actions to better characterize the PuO<sub>2</sub> problem were delayed by approximately 6 months because the WTP project delayed evaluation of the report.

### **Recommendation**

Taken as a whole, the investigative record convinces the Board that the safety culture at WTP is in need of prompt, major improvement and that corrective actions will only be successful and enduring if championed by the Secretary of Energy. The Board recommends that the Secretary of Energy:

1. assert federal control at the highest level and direct, track, and validate the specific corrective actions to be taken to establish a strong safety culture within the WTP project consistent with DOE Policy 420.1 in both the contractor and federal workforces,
2. conduct an Extent of Condition Review to determine whether these safety culture weaknesses are limited to the WTP Project, and
3. conduct a non-adversarial review of Dr. Tamosaitis' removal and his current treatment by both DOE and contractor management and how that is affecting the safety culture at WTP.

The Board urges the Secretary to avail himself of the authority under the Atomic Energy Act (42 U.S.C. § 2286d(e)) to "implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection."

*/s/ Peter S. Winokur, Ph.D., Chairman*

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## Appendix B: Reporting Requirements

Date	Addressee	Topic
Jan 25	Deputy Secretary of Energy	DOE's Expedited Processing of Directives
Feb 4	Administrator, NNSA	Storage of Uranium in Building 9720-5 at the Y-12 National Security Complex
Feb 8	Administrator, NNSA	Potential Changes to Safety Strategy for Los Alamos Chemistry and Metallurgy Research Replacement Project
Mar 28	Administrator, NNSA	Activity-Level Work Planning and Control at Nevada National Security Site
Apr 5	Assistant Secretary for Environmental Management	Spray Leak Analyses for Hanford Waste Treatment and Immobilization Plant
Apr 5	Administrator, NNSA	Implementation of DOE-NA-STD-3016, <i>Hazard Analysis Reports for Nuclear Explosive Operations</i> , at Nuclear Weapon Design Agencies
Apr 8	Deputy Secretary of Energy	Issues with Software for Analysis of Soil-Structure Interaction
Apr 20	Administrator, NNSA	Safety Strategy for New Facilities at the Y-12 National Security Complex
Apr 26	Assistant Secretary for Environmental Management	Waste Transfer System at Hanford Tank Farms
May 5	Assistant Secretary for Environmental Management	Instrumentation and Control System Design for Hanford Waste Treatment and Immobilization Plant
May 16	Administrator, NNSA	Safety Basis and Control Strategy for Tritium Facility at Lawrence Livermore National Laboratory
Jun 7	Assistant Secretary for Environmental Management	Use of Low Order Accumulation Model for Waste Treatment and Immobilization Plant
Jun 24	Assistant Secretary for Environmental Management	Fire Protection Program at Waste Isolation Pilot Plant
Aug 3	Acting Assistant Secretary for Environmental Management	Heat Transfer Analyses for Vessels in the Hanford Waste Treatment and Immobilization Plant
Aug 19	Administrator, NNSA	Documented Safety Analysis for Savannah River Site Tritium Facilities
Aug 25	Administrator, NNSA	Technical Procedures at the Y-12 National Security Complex
Sept 13	Acting Assistant Secretary for Environmental Management	Ammonia Hazards and Controls at the Hanford Waste Treatment and Immobilization Plant
Oct 6	Acting Assistant Secretary for Environmental Management	Maintenance Program at the Hanford Waste Encapsulation and Storage Facility
Nov 7	Deputy Administrator for Defense Programs	Nuclear Explosive Safety Findings at the Pantex Plant
Dec 13	Administrator, NNSA	Safety System Design, Functionality, and Maintenance at Lawrence Livermore National Laboratory
Dec 29	Administrator, NNSA	Activity-Level Work Planning and Control at the Y-12 National Security Complex

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**Appendix C: Significant Board Correspondence**  
**(letters available on both the Board's and DOE's websites)**

**Hanford**

February 16 letter informing the Secretary of Energy that the Board is conducting an investigation of health and safety concerns described in a letter from an employee on the Hanford Waste Treatment and Immobilization Plant project.

February 25 letter and staff report regarding activity-level work planning and control processes and their implementation at Washington Closure Hanford, LLC.

March 30 letter concerning recent conduct of operations observations at the Hanford Tank Farms.

April 5 letter establishing a 60-day reporting requirement on DOE's spray leak analysis and methodology for the Waste Treatment and Immobilization Plant.

April 26 letter establishing a 90-day reporting requirement for a briefing and report on actions to address the deficiencies associated with the waste transfer system at Hanford.

May 5 letter establishing a 30-day reporting requirement for a briefing and report to address the deficiencies in the instrumentation and control system design for the Waste Treatment and Immobilization Plant.

May 20 letter reaffirming Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*, with a 30-day final decision requirement to implement all or part of the Recommendation.

June 7 letter establishing a 60-day reporting requirement on the continued use of the Low Order Accumulation Model for calculating accumulation of solids in vessels in the Waste Treatment and Immobilization Plant.

June 9 letter forwarding Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

June 9 letter addressing concerns about boreholes near Tank C-105 at the Hanford Site.

June 30 letter responding to the June 22, 2011, DOE Letter requesting access to the Board's investigative files pertaining to Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

August 3 letter establishing a 60-day reporting requirement on the validity of the heat transfer analyses for process vessels in the Pretreatment Facility at Hanford's Waste Treatment and Immobilization Plant.

August 3 letter forwarding public comments concerning Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

August 12 letter clarifying and establishing a 45-day requirement for responding to Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

September 13 letter establishing a 60-day reporting requirement on the hazards and controls associated with the anhydrous ammonia system at the Waste Treatment and Immobilization Plant.

October 6 letter establishing a 60-day reporting requirement regarding the maintenance program at the Hanford Waste Encapsulation and Storage Facility.

October 13 letter regarding DOE's clarification response on September 19, 2011, on Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

### **Lawrence Livermore National Laboratory**

April 1 letter highlighting areas where training could be improved at Lawrence Livermore National Laboratory.

May 16 letter establishing a 30-day reporting requirement for a briefing and report to provide the rationale for the current proposed safety basis and control strategy for the Tritium Facility at Lawrence Livermore National Laboratory.

December 13 letter establishing a 60-day reporting requirement for a briefing and report on safety functions of the Lawrence Livermore National Laboratory Plutonium Facility's glovebox systems and Fire Detection and Alarm System, and a 1-year reporting requirement on other issues.

### **Los Alamos National Laboratory**

February 8 letter establishing a 30-day reporting requirement for a briefing on NNSA's decision process, timing, and bases for changes related to Board concerns resolved under the Chemistry and Metallurgy Research Replacement project certification process.

### **Nevada National Security Site**

March 28 letter establishing a 90-day reporting requirement for a report on work planning and control process improvements by the Nevada Site Office and National Security Technologies, LLC.

## **Pantex Plant**

November 7 letter establishing a 3-month reporting requirement for a briefing and report regarding plans to address the issues/weaknesses in the tracking and closure process for Nuclear Explosive Safety findings at the Pantex Plant.

## **Sandia National Laboratories**

February 28 letter to Citizen Action New Mexico responding to its concerns regarding consequences to the public from potential accidents at Sandia National Laboratories.

September 2 letter in response to Citizen Action New Mexico regarding the safe operation of the Annular Core Research Reactor at Sandia National Laboratories.

## **Savannah River Site**

January 28 letter accepting Revision 6 of the Implementation Plan for Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*.

February 28 letter expressing concern about the lack of viable disposition paths for fissile materials and other excess nuclear materials in light of the recent suspension of dissolver operations at the H-Canyon facility at the Savannah River Site.

August 19 letter establishing a 90-day reporting requirement for the revised safety basis at the Savannah River Site tritium facilities.

December 7 letter closing Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*, noting that DOE has made satisfactory progress toward meeting the intent of the Recommendation and that open commitments will be tracked using the Board's normal oversight processes.

## **Waste Isolation Pilot Plant**

June 24 letter establishing a 180-day reporting requirement on actions taken or planned by DOE to address weaknesses in the fire protection program at the Waste Isolation Pilot Plant.

## **Y-12 National Security Complex**

February 4 letter establishing a 90-day reporting requirement for a briefing and report on storage in Building 9720-5 at Y-12.

April 20 letter establishing a 30-day reporting requirement for a report and a briefing on safety strategy for new facilities at Y-12.

August 25 letter establishing a 6-month reporting requirement regarding weaknesses in conduct of operations and technical procedures at Y-12.

December 29 letter establishing a 120-day reporting requirement for NNSA's assessment of the effectiveness of actions to address work planning and control weaknesses at Y-12.

### **Other Correspondence**

January 25 letter establishing a 30-day reporting requirement for a briefing and report on anticipated improvements to public and worker safety resulting from the expedited directives review process and resolution of staff comments on two DOE orders.

April 5 letter establishing a 90-day reporting requirement for a report on actions taken to completely implement Standard DOE-NA-STD-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations*.

April 8 letter establishing a 45-day reporting requirement on issues related to the System for Analysis of Soil Structure Interaction computer software code.

April 27 letter establishing a 30-day Final Decision requirement, in response to the partial rejection of Board Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*.

June 15 letter forwarding a copy of the Report to Congress on the Status of Significant Unresolved Issues with the Department of Energy's Design and Construction Projects.

September 23 letter forwarding a copy of the Report to Congress on the Status of Significant Unresolved Issues with the Department of Energy's Design and Construction Projects.

September 30 letter forwarding a copy of the second periodic Report to Congress on the Significant Safety-Related Infrastructure Issues at Operating Defense Nuclear Facilities.

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