

Peter S. Winokur, Chairman
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Joseph F. Bader
Sean Sullivan

**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



October 30, 2013

The Honorable Ernest J. Moniz
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Moniz:

The Defense Nuclear Facilities Safety Board (Board) is pleased to enclose its Fourth Annual Report to Congress: *Summary of Significant Safety-Related Aging Infrastructure Issues at Operating Defense Nuclear Facilities*. The Board fashioned this report after its periodic *Report to Congress on the Status of Significant Unresolved Issues with the Department of Energy's Design and Construction Projects*. The Board believes this report provides an appropriate means of keeping all parties apprised of the Board's safety-related concerns regarding aging infrastructure at Department of Energy (DOE) defense nuclear facilities. The Board intends to issue this report to Congress and DOE once per year, or more frequently if warranted.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mrs. Mari-Jo Campagnone

October 30, 2013

To the Congress of the United States:

This is the Defense Nuclear Facilities Safety Board's (Board) fourth annual report on safety issues associated with aging infrastructure at Department of Energy (DOE) defense nuclear facilities. DOE relies on several facilities that are at or near the end of life, but still must carry out national security and legacy waste cleanup missions. During the past year, DOE made progress tackling issues concerning some aging facilities listed in this report. The enclosure to this letter provides additional details on these issues.

Two of the most critical facilities are the Chemistry and Metallurgy Research (CMR) Facility at Los Alamos National Laboratory (LANL), constructed in 1952, and the 9212 Complex at the Y-12 National Security Complex that began service in 1951. DOE deferred funding for the CMR Replacement Project for five years, and expects to operate the existing CMR Facility through 2019. The 9212 Complex is comprised of Building 9212 and thirteen collocated buildings, portions of which have been in operation for more than 60 years. The Uranium Processing Facility (UPF) is scheduled to replace the 9212 Complex, but DOE does not plan to commence operations in UPF until 2025.

A third facility of concern to the Board is the Plutonium Facility (PF-4) at LANL. PF-4 was designed and constructed in the 1970s and lacks the structural ductility and redundancy required by today's building codes and standards. In 2007, a DOE-required periodic reanalysis of the seismic threat present at the Los Alamos site was completed. It indicated a greater than fourfold increase in the predicted earthquake ground motion. Total facility collapse is now considered a credible event. PF-4, the nation's sole plutonium fabrication center, contains significant amounts of plutonium, much of it in a form that is readily dispersible (i.e., powders and liquids), and is stored in containers that have not been certified to survive facility collapse. The resulting radiation dose consequence to the public following such an event was determined to exceed DOE's allowed evaluation levels by several orders of magnitude. The Board formally identified its concerns with the issuance of Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*.

In response to this increased seismic threat, LANL undertook a series of actions to improve the safety posture of PF-4. These actions included efforts to reduce the likelihood and severity of a post-seismic fire, and address the nine known building weaknesses that could lead to loss of PF-4's ability to confine its nuclear material or total structural collapse. A more detailed seismic analysis to further refine PF-4's response to a major earthquake was also undertaken and completed in September 2012. It identified two additional weaknesses that would result in collapse. Detailed planning to address these weaknesses has been initiated by LANL.

The Board, in its July 18, 2012, letter, expressed concern that this latest analysis was proceeding without adequate definition and technical justification. Subsequently, the Deputy Secretary of Energy, in his September 28, 2012, response to the Board, reported that he had directed the National Nuclear Security Administration to initiate action to evaluate PF-4 using a

second modeling approach. This alternate analysis is currently being performed by an independent engineering firm. Final results are expected in December 2013. The Board awaits these results before reaching final conclusions on the appropriate urgency of compensatory and corrective actions.

Other facilities meriting continued attention are the high-level waste tank farms at the Hanford Site and the Savannah River Site, the Radioactive Liquid Waste Treatment Facility at LANL, and T Plant (Waste Storage, Treatment, and Packaging Operations) at the Hanford Site.

SIGNIFICANT SAFETY-RELATED AGING INFRASTRUCTURE ISSUES

The following are the most significant safety-related aging infrastructure issues that exist today in the DOE defense nuclear complex. The enclosure to this letter provides additional detail on these issues.

- **Los Alamos National Laboratory, Plutonium Facility**—seismic fragility of building, and degraded safety system reliability.
- **Los Alamos National Laboratory, Chemistry and Metallurgy Research Facility**—seismic fragility of building.
- **Los Alamos National Laboratory, Radioactive Liquid Waste Treatment Facility**—building and equipment end of life.
- **Nevada National Security Site, Device Assembly Facility**—degradation of water tank and fire suppression system lead-ins.
- **Pantex Plant, Site-Wide Fire Suppression Systems**—degradation of fire suppression systems.
- **Y-12 National Security Complex, 9212 Complex**—seismic and high wind fragility of building, and building and equipment end of life.
- **Hanford Site, Single-Shell and Double-Shell Tank Farms**—aging tanks.
- **Hanford Site, T Plant (Waste Storage, Treatment, and Packaging Operations)**—seismic fragility of building.
- **Savannah River Site, H-Canyon**—aging systems and structures.
- **Savannah River Site, Tank Farms**—aging tanks.

- **Savannah River Site, A-Area, Fire Protection Water Supply Systems**—degraded pumps and tank.

NEW ISSUES ADDED DURING THE PAST YEAR

- **Hanford Site, Double-Shell Tank Farms**—aging tanks.
- **Savannah River Site, A-Area, Fire Protection Water Supply Systems**—degraded pumps and tank.

ISSUES REMOVED FROM THE REPORT DURING THE PAST YEAR

- **None**

As directed by Congress, the Board will continue to exercise its existing statutory authority in addressing these and other safety-related issues within the DOE defense nuclear complex.

Respectfully submitted,

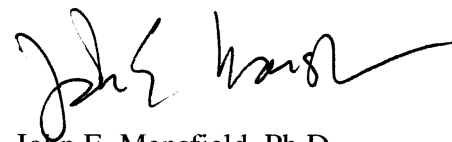


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Joseph F. Bader*
Member



John E. Mansfield, Ph.D.
Member



Sean Sullivan
Member

Enclosure

* Board Member Joseph F. Bader took no part in the consideration or decision of this report.

ENCLOSURE

**SUMMARY OF SIGNIFICANT SAFETY-RELATED AGING INFRASTRUCTURE
ISSUES AT OPERATING DEFENSE NUCLEAR FACILITIES**

| NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES | | | | | |
|---|---------------------------|----------------------|--------------------------|--|--|
| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
| Los Alamos National Laboratory (LANL) | Plutonium Facility (PF-4) | 1978 | Approximately 30 years | <p>Seismic fragility of building: Seismic analyses of PF-4 completed in May 2011 and September 2012 identified building vulnerabilities that could result in loss of confinement or facility collapse with resulting high radiological dose consequence to workers and the public.</p> <p>Reference: The Board's Recommendation 2009-2, <i>Los Alamos National Laboratory Plutonium Facility Seismic Safety</i>, October 26, 2009; letter from the Board dated July 18, 2012.</p> <p>Safety system reliability: The facility lacks a set of safety controls (fire suppression system and active confinement ventilation system) that would adequately protect the public and workers from the consequences associated with post-seismic accidents.</p> <p>Reference: The Board's Recommendation 2009-2, <i>Los Alamos National Laboratory Plutonium Facility Seismic Safety</i>, October 26, 2009.</p> | <p>The National Nuclear Security Administration (NNSA) aggressively completed structural upgrades that addressed each of the nine building vulnerabilities identified in the May 2011 seismic analysis.</p> <p>To gain a more complete understanding of PF-4's seismic response, NNSA completed a more rigorous seismic analysis in September 2012, which identified two additional collapse vulnerabilities. Plans to address these vulnerabilities are being formulated.</p> <p>The Board, in its July 18, 2012, letter, expressed concern that this additional analysis was proceeding without adequate definition and technical justification. Subsequently, the Deputy Secretary of Energy, in his September 28, 2012, response, reported that he had directed NNSA to initiate action to evaluate PF-4 using a second modeling approach. This alternate analysis is currently being performed by an independent engineering firm. Final results are expected in December 2013.</p> <p>The timely identification and remediation of any structural vulnerabilities will have profound implications for ensuring public health and safety.</p> <p>In parallel with efforts to address the issue of potential collapse of the structure noted above, NNSA is continuing to pursue seismic upgrade of the fire suppression and key portions of the active confinement ventilation systems.</p> |

NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES

| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
|---|---|---------------|---|---|---|
| <p>LANL (continued)</p> | <p>Chemistry and Metallurgy Research (CMR) Facility</p> | <p>1952</p> | <p>Until replaced by CMR Replacement Project, date to be determined (TBD)</p> | <p>Seismic fragility of building: There is a 1 in 55 chance of seismic collapse during a 10-year timeframe, which would result in release of nuclear material and injury/death of facility workers.</p> <p>Reference: Letters from the Board dated October 23, 2007, and December 7, 2010.</p> | <p>The Board is concerned that prolonged operations in the existing CMR Facility pose a serious safety risk to workers. In late 2010, the NNSA limited material-at-risk in the facility to reduce the public dose consequence following an earthquake to a value below the Evaluation Guideline of 25 rem.</p> <p>In February 2012, NNSA deferred the CMR Replacement Project for a minimum of five years, but committed to cease nuclear operations in CMR by 2019.</p> <p>NNSA intends to conduct the Confinement Vessel Disposition Project in CMR that will remove nuclear material from the vessels and safely package the material for disposition.</p> |

NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES

| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
|--------------------------------|--|---------------|--|--|---|
| <p>LANL (continued)</p> | <p>Radioactive Liquid Waste Treatment Facility (RLWTF)</p> | <p>1963</p> | <p>Until replaced by Radioactive Liquid Waste Treatment Upgrade Project (expected in 2020)</p> | <p>Building and equipment end of life: RLWTF has reached its end of life and, despite ongoing life-extension efforts, requires replacement to support future laboratory missions reliably. Equipment failures pose a risk to facility workers.</p> <p>Reference: Letter from the Board dated March 5, 2008.</p> | <p>This facility collects liquid radioactive wastewater from many LANL nuclear facilities, so its failure would significantly impact missions.</p> <p>Cost growth associated with the original RLWTF Upgrade Project resulted in NNSA evaluating alternative approaches. NNSA split the replacement project into separate facilities for low-level waste (LLW) and transuranic level waste. NNSA achieved 90% of design completion for the LLW phase and expects to reach Critical Decision (CD)-2 (approve alternative selection and cost range) in February 2014.</p> |

NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES

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|---|---------------------------------------|---------------|---|---|---|
| <p>Nevada National Security Site</p> | <p>Device Assembly Facility (DAF)</p> | <p>1996</p> | <p>Enduring facility—remaining service date TBD</p> | <p>Degradation of water tank: The water tank cannot be relied upon to provide fire suppression water in the event of a fire in DAF. Fires at DAF pose a risk to facility workers.</p> <p>Reference: Letter from the Board dated January 18, 2008.</p> <p>Degradation of fire suppression system lead-ins: The lead-ins are corroding and cannot be relied upon to provide water in the event of a fire. Three lead-ins are leaking, and the associated portion of the fire suppression system is out of service.</p> <p>Reference: Letter from the Board dated January 18, 2008.</p> | <p>The water tank is corroded on interior and exterior surfaces. The tank also is in violation of standards of the Occupational Safety and Health Administration and noncompliant with standards of the American Water Works Association. The tank does not meet seismic requirements.</p> <p>NNSA included the water tank in a new comprehensive project plan that should address the full scope of deficiencies in the DAF fire suppression system.</p> <p>The lead-ins are susceptible to failure due to potential corrosion throughout the entire fire suppression system. Internal coatings of pipes failed almost immediately after installation because of improper welding. In 2012, NNSA began repairs and approved a new comprehensive project plan that should address all deficiencies.</p> |

NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES

| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
|---------------------|------------------------------------|---------------|-----------------------------|---|--|
| Pantex Plant | Site-Wide Fire Suppression Systems | 1950s | Until replaced— date TBD | <p>Degradation of fire suppression systems: Sprinkler lead-ins that have not been replaced exhibited corrosion-related failures. Replacement of portions of the fire water systems' underground piping is being delayed. Aging fire detection system components are no longer being manufactured. There is a potential for fire systems to fail when needed due to a lack of redundancy. Fires at Pantex pose a risk to facility workers and the public.</p> <p>Reference: Letters from the Board dated September 23, 2002, and February 25, 2013.</p> | <p>The frequency of failures of the aging fire protection systems and key components at Pantex increased in recent years. NNSA continues efforts to upgrade fire protection systems and associated components (sprinkler lead-ins, sprinkler deluge valves, fire water mains, and fire detection system). In Fiscal Year (FY) 2013 this work was funded under the Readiness in Technical Base and Facilities Program.</p> <p>Fire systems upgrade is estimated to take 10 or more years, is not guaranteed to be adequately funded from year-to-year, and is progressing slowly. Given the current schedule, the potential exists for component failures to exceed the availability of certified spare parts for some systems.</p> |

NATIONAL NUCLEAR SECURITY ADMINISTRATION SITES

| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
|--|---|---------------|---|---|---|
| <p>Y-12 National Security Complex</p> | <p>9212 Complex (Building 9212 and thirteen collocated buildings)</p> | <p>1951</p> | <p>Until replaced by the Uranium Processing Facility (UPF); full replacement of 9212 Complex process capability expected no earlier than 2025</p> | <p>Seismic and high wind fragility of building: Results of analyses of the building's structure indicate that it would not withstand performance category-2 seismic loads, and that many of the building's systems and components have insufficient seismic restraint. Also, the roof would be damaged by a performance category-2 wind event. Failure of the buildings or systems could lead to unacceptable consequences for facility workers.</p> <p>Reference: Letters from the Board dated April 20, 2005, November 28, 2005, and March 13, 2007.</p> <p>Building and equipment end of life: The 9212 Complex has reached its end of life. Facility systems and components continue to deteriorate and further increase operational safety risk.</p> <p>Reference: Letters from the Board dated April 20, 2005, November 28, 2005, and March 13, 2007.</p> | <p>The 9212 Complex cannot meet existing requirements for Hazard Category 2 nuclear facilities. NNSA took actions to reduce the radioactive material in the facilities. NNSA concluded that major structural and process modifications would be impractical because of the cost involved and the likelihood that construction could significantly disrupt important national security missions. Construction of the new UPF is the long-term solution to this issue. Based on current project documentation, full replacement of 9212 Complex process capabilities in UPF is expected no earlier than FY 2025. This represents approximately a two year slip in schedule.</p> <p>The 9212 complex is more than 60 years old and is continuing to deteriorate. NNSA initiated a project to upgrade certain systems in the 9212 Complex based on a facility risk review. Construction of the new UPF in conjunction with continued efforts to analyze and address the risk posed by deteriorating systems is the long-term solution to this issue. Full replacement of 9212 Complex process capabilities in UPF is expected no earlier than FY 2025. The slip in schedule for UPF could result in some capabilities within Building 9212 operating longer than previously planned (i.e., special processing and casting). The specific impacts of delays to UPF are being evaluated by the Y-12 contractor.</p> |

| ENVIRONMENTAL MANAGEMENT SITES | | | | | |
|--------------------------------|--|---------------|---------------------------------------|--|---|
| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
| Hanford Site | Single-Shell and Double-Shell Tank Farms | 1943–1986 | Until cleaned and closed: 2019–2052 | <p>Aging tanks: The older single-shell tanks containing high-level radioactive waste are beyond their design lives, and some have leaked. Some double-shell tanks, though newer, are beyond their design lives, and the waste in one such tank has leaked into the secondary containment of that tank.</p> <p>Reference: Letters from the Board dated January 6, 2010, and June 20, 2013.</p> | The Department of Energy (DOE) stores radioactive waste in 149 single-shell tanks and 28 double-shell tanks until the waste can be removed for treatment and disposal, which could take 30 or more years. DOE plans to use single-shell and double-shell tanks until 2047 ¹ and is evaluating options for extending the lives of the tanks. The Board issued a letter dated January 6, 2010, encouraging DOE to develop more efficient tank inspection techniques. |
| | T Plant (waste storage, treatment, and packaging operations) | 1944 | Until storage mission is complete—TBD | <p>Seismic fragility of building: Portions of the T Plant structure do not meet minimum reinforcement requirements of American Concrete Institute (ACI) code ACI 318, and are susceptible to failure in an earthquake. Structural failures pose a risk to facility workers.</p> <p>Reference: Letter from the Board dated April 4, 2003.</p> | <p>The Board letter dated April 4, 2003, indicates that the T Plant's seismic capacity is satisfactory for K-Basin Sludge storage.</p> <p>T Plant is almost 70 years old and does not meet minimum building code requirements for structural concrete. As such, T Plant may not be suitable for additional missions such as sludge processing or other remote-handled transuranic waste processing.</p> |

¹ The 2047 date is based on treating tank waste in all tanks (Single-Shell and Double-Shell), and changes from the date shown in last year's report because of the addition of aging Double-Shell Tanks.

| ENVIRONMENTAL MANAGEMENT SITES | | | | | |
|--------------------------------|----------|---------------|--|--|--|
| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
| Savannah River Site (SRS) | H-Canyon | 1955 | Until processing mission is complete—TBD | <p>Aging systems and structures: H-Canyon is exhibiting degradation of systems and structures that if not addressed, could challenge safe operations and pose a risk to facility workers. The contractor previously identified several components that show localized degradation including the canyon wall concrete, electrical wiring, and the canyon roof liner.</p> <p>Reference: Letter from the Board dated April 29, 2010.</p> | <p>DOE resumed processing spent fuel in H-Canyon, and is also preparing for a plutonium processing mission.</p> <p>DOE completed repairs to address some of the identified deficiencies, such as a damaged section of the wall concrete.</p> <p>There are some safety-related repairs that have not yet been completed, such as work on aging wiring in the Nuclear Incident Monitoring System.</p> <p>Additionally, DOE discontinued the Integrated Facility Aging Management program, which had been used to assess aging infrastructure issues at H-Canyon. DOE is attempting to manage these issues through other means.</p> |

| ENVIRONMENTAL MANAGEMENT SITES | | | | | |
|--------------------------------|---|---------------|---|---|--|
| SITE | FACILITY | BEGAN SERVICE | REMAINING SERVICE | INFRASTRUCTURE WEAKNESS | COMMENTS |
| SRS (continued) | Tank Farms | 1954– 1962 | Until removed from service— 2028 | <p>Aging tanks: The Type I, II, and IV Tanks containing high-level radioactive waste are beyond their design lives, and some have leaked.</p> <p>Reference: Letter from the Board dated January 6, 2010.</p> | DOE made progress in removing radioactive waste from old-style tanks. However, DOE expects that storage of waste in old-style tanks will continue for many more years. Plans recently issued by DOE show that this storage will continue for longer than previously expected. The Board issued a letter dated January 6, 2010, encouraging DOE to develop more efficient tank inspection techniques. DOE has been working on developing such techniques. |
| | A-Area Fire Protection Water Supply Systems | 1950s | Until upgrades complete— date TBD | <p>Degraded pumps and tank: The pumps used for the fire protection water supply have degraded and are no longer code-compliant. The water supply tank has rusted and no longer has the required thickness in some areas.</p> <p>Reference: Letter from the Board dated March 27, 2012.</p> | DOE took some interim actions to improve the situation in A-Area, and acknowledged the need to replace the pumps and tank. DOE has not identified funding for that upgrade. |