

Recent DNFSB Impacts

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- Safeguarding DOE's Defense Nuclear Facilities Against Earthquakes. •
- Preparing DOE Sites to Respond to Emergencies Involving Radioactive Materials.
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- Working with DOE to Address Challenges with Aging Safety Infrastructure.
- Improving Fire Protection at DOE's Defense Nuclear Facilities. •
- Ensuring DOE can Safely Transport Nuclear Materials Within its Site ٠ Boundaries.
- Improving Nuclear Safety at an Unused Facility at SRS Containing a Very ٠ Highly Radioactive Form of Plutonium.
- Maintaining Disciplined Operations at Defense Nuclear Facilities. ٠
- Addressing Safety Allegations from Workers and the Public.







Ensuring DOE can Safely Produce Plutonium Pits for the Nuclear Weapons Stockpile



Advising DOE to <u>improve safety controls</u> for the Savannah River Plutonium Processing Facility instead of relying on workers to use their senses to detect accidents such as a spill of material or a fire and exit before receiving significant radiological exposure.

Plutonium is a radioactive material that poses significant hazards to workers and the public and pits are *plutonium triggers* that sit at the heart of every US nuclear weapon.





Legacy container types used to store plutonium (top) versus new engineered and robust containers DOE developed in response to the DNFSB's <u>Recommendation</u> <u>2005-1</u>, *Nuclear Material Packaging* (bottom right), and recent usage at LANL (bottom left).

Ensuring DOE can Safely Produce Plutonium Pits for the Nuclear Weapons Stockpile





DNFSB has been working with DOE to enhance the <u>robustness</u> <u>and reliability of safety systems</u>—such as the building structure, the fire suppression system (pictured above), and the ventilation system—at the Plutonium Facility at LANL.



Major seismic retrofits to strengthen the girders (top) and roof (bottom) for the Plutonium Facility at LANL.

Safeguarding DOE's Defense Nuclear Facilities Against Earthquakes



DNFSB worked with DOE to conduct testing and <u>develop a state-</u> of-the-art model to ensure the Plutonium Facility at LANL would prevent the release of radioactive material following a significant







Strengthening DOE's nuclear safety guidance to ensure that modern science is used to predict the strength of earthquakes on a routine basis, facility structures and safety systems are promptly assessed to determine whether they can withstand the new hazard, and deficient systems are retrofitted in a timely manner. DOE also issued an **Operating Experience** to disseminate guidance to its facilities on how to address the DNFSB's safety concerns in May 2023.



DNFSB identified a vulnerability in the Reduction-Oxidation Plant Canyon structure at the Hanford Site that increased the possibility of a collapse during and after an earthquake, which would allow the release of radiological material. As a result, DOE and its contractor upgraded the roof structure to eliminate the vulnerability. This action resulted from staff-tostaff discussions.



Preparing DOE Sites to Respond to Emergencies Involving Radioactive Materials



Defense nuclear facilities must be prepared to respond to fires, explosions, spills, and other emergencies involving radioactive materials.



DNFSB <u>Recommendation 2014-1, Emergency</u> <u>Preparedness and Response</u>, prompted DOE to issue new requirements for defense nuclear facilities to plan for and practice their response to severe events, including natural disasters.

In response to advice from the DNFSB, SRS personnel performed a series of assessments and emergency exercises to demonstrate they were ready to respond to a large-scale release of radioactive tritium.

Preparing DOE Sites to Respond to Emergencies Involving Radioactive Materials





Subsequent to the DNFSB's <u>Recommendation 2014-1</u>, LANL strengthened realism associated emergency response training. Firefighters practice extinguishing simulated burning plutonium in a glovebox (left) and emergency responders during an emergency exercise.



Advising DOE on Safely Disposing of its Solid Nuclear Waste





DOE sites routinely generate, process, and store solid nuclear wastes. During the past decade, DOE experienced two significant events—one in 2014 at WIPP and another in 2018 at INL—in which waste drums released radiological materials due to energetic chemical reactions involving the waste.



DOE has made many improvements to the safe storage of solid nuclear waste because of advice and guidance from the DNFSB including installing new controls such as lid restraints on drums with <u>elevated flammable gas hazards at the INL</u>.

Advising DOE on Safely Disposing of its Solid Nuclear Waste

Area G Radioactive Waste Storage Facility at LANL



Solid Waste Management Facility at SRS

Aboveground facilities at WIPP DOE depends on its solid radioactive waste to be <u>benign and unreactive</u> as it awaits disposal sitting in barrels in tent-like structures prior to permanent disposal at WIPP. DNFSB advice has strengthened DOE's processes to ensure this assumption is valid.







Ensuring Nuclear Weapons are Safely Assembled, Disassembled, and Refurbished



DOE produces the Nation's nuclear weapons at the Pantex Plant near Amarillo, Texas. This work must be conducted with *extreme discipline to prevent accidental* detonation of high explosives.



In response to the DNFSB's <u>Recommendation</u> <u>2019-1</u>, DOE addressed numerous legacy nuclear safety issues related to nuclear explosive facilities and operations at the Pantex Plant. This includes upgrading facility infrastructure including replacement of ceilings in facilities where nuclear explosives are built and taken apart, minimizing the potential for debris to fall on nuclear explosives and cause an explosion.





Ensuring Nuclear Weapons are Safely Assembled, Disassembled, and Refurbished





Aerial view of the Pantex Plant, the only location where America's nuclear weapons can be assembled, disassembled, and refurbished.



DNFSB's <u>Recommendation 2019-1</u>, resulted in additional safety controls designed to prevent accidental high explosive detonation and worker loss of life across weapon programs.



Helping DOE Integrate Safety into its Significant Investments in Design and Construction Projects



DNFSB advised DOE that the continuous air monitors that activate the Safety Significant Confinement Ventilation System at the WIPP had <u>not been tested in conditions</u> <u>representative</u> of the dusty-salt environment where they will need to function. After DNFSB engaged, DOE agreed to start the system in the safety-related mode until they could resolve these concerns.

DOE is currently investing tens of billions of dollars into replacing and refurbishing its aged defense nuclear facilities that support the nuclear deterrent and the cleanup of nuclear waste. DNFSB prioritizes its mandate from Congress to ensure that safety issues are identified and resolved early in the design process.



DNFSB noted <u>evidence of seismic faults</u> in the underground tunnels at NNSS that DOE had not adequately studied. If these faults are found to be active, the design for seismic-related safety controls in the facility would need to change. After the DNFSB acted, DOE agreed to study the faults.



Helping DOE Integrate Safety into its Significant Investments in Design and Construction Projects



Savannah River Plutonium Processing Facility will produce essential components for the nation's nuclear deterrent. DNFSB has provided DOE <u>significant advice</u> <u>on how to improve safety</u> in the design of this \$20+ billion construction project. Technical Area 55 at LANL at night, which includes the Plutonium Facility. DNFSB has provided DOE with safety advice that would <u>improve the adequate protection</u> of the public and workers while also making the facility more resilient to produce plutonium pits for the Nation's nuclear deterrent. DOE is current investing several billions into this facility.



Preventing Accidents Involving Nuclear Chain Reactions that can be Fatal to Workers





DNFSB conducted criticality safety reviews across the DOE complex that identified issues and improved multiple areas such as uranium accumulation in out-of-service equipment, labeling of legacy containers, tracking material-at-risk, increasing the rigor of criticality safety evaluation bases, and strengthening the interface between criticality safety personnel and other work groups at DOE sites. DNFSB also emphasized learning from the criticality safety violations shown in the above images.

Nuclear criticality accidents are uncontrolled chain reactions that can result in fatal radiation doses to workers.



Subsequent to the DNFSB's <u>Recommendation 2007-1</u>, *Safety-Related In Situ Nondestructive Assay of Radioactive Materials*, the American Nuclear Society issued a new national consensus standard on nondestructive assay measurements for criticality safety (ANS-8.28-2024). Nondestructive assay plays an important role in monitoring processes that use nuclear material to ensure safe operations.



Preventing Accidents Involving Nuclear Chain Reactions that can be Fatal to Workers

Former Board members Brown (left) and Bader (right) perform nuclear criticality measurements as part of a training class offered by LLNL. The Board has continually encouraged DOE to maintain this type of training to ensure its workforce remains safe. LANL, LLNL, SNL and NNSS are now working together to offer current training options.



Working with DOE to Address **Challenges with Aging Safety** Infrastructure

DOE's defense nuclear complex developed over an 80year period following the Manhattan Project. Many of the key defense nuclear facilities that support the nation's nuclear deterrent are more than 40 years old.

For the past two decades, DNFSB has provided advice to DOE on the aging Y-12 National Security Complex where they produce key components for nuclear weapons. In recent years, these acute aging infrastructure concerns at Y-12 prompted several actions to ensure that weapon components can continue to be safely produced, including:

- Facility upgrades,
- Enhanced system monitoring, and
- Reductions in excess nuclear materials.



Safety Case:

supporting nuclear operations

Programmatic Case:

availability and interrupt programmatic operations

Financial Case:

strained upgrade and modernization budgets

Strengthening DOE's aging infrastructure management requirements would yield safety, programmatic, and financial benefits

> Enhances the long-term reliability and resilience of safety-related infrastructure

> Reduces infrastructure failures from age-related degradation that impact facility

> Prolongs the effective life of safety-related infrastructure easing burdens on



Aging Safety Infrastructure Management Campaign

DNFSB held a public hearing regarding aging infrastructure management with a discussion of common issues and best practices with the Nuclear Regulatory Commission, National Aeronautics and Space Administration, Government Accountability Office, Army Corps of Engineers, and the American Nuclear Society. The lessons learned from this effort are being used to spearhead a series of workshops with DOE to implement best practices within their organization.





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Improving Fire Protection at DOE's Defense Nuclear Facilities



Fires are a major hazard for defense nuclear facilities because they can release radioactive materials into the environment and expose workers and the public. At the Hanford Site, DOE's contractor found fire sprinkler system pipes to be partially clogged with corrosion products at the Central Waste Complex. This issue was further complicated by the discovery that a significant number of required inspections had been missed. As a result, the DNFSB's resident inspectors questioned whether the discovery constituted a nuclear safety violation. Ultimately, the contractor performed an extent of condition review, determined periodic pipe inspections had lapsed for nearly all fire protection systems at the Hanford Site, and initiated a plan to immediately inspect them. DNFSB's involvement was instrumental in motivating Hanford to conduct this review.



DNFSB <u>identified</u> the recent use of cast-iron components in piping for fire suppression systems at the Pantex Plant. Cast-iron is a brittle material that can easily fracture during an earthquake rendering the system unable to extinguish a fire and result in the release of radioactive material. DOE acknowledged this safety issue and alerted all its sites about this problem in an Operating Experience level-3 document.



Management at the Central Waste Complex at the Hanford site began accelerating efforts for removing wooden pallets and switching to metal pallets based on concerns raised by the DNFSB resident inspectors and DOE experts. Wooden pallets can collapse during a fire, allowing a stack of waste drums to topple and spread radioactive materials. Subsequently, Central Waste Complex personnel have initiated interim efforts to unstack wooden pallets, which avoids the toppling issues.





Ensuring DOE can Safely Transport Nuclear Materials Within its Site Boundaries

Transportation of radioactive materials between DOE's defense nuclear facilities occurs frequently to support its national security and environmental cleanup missions. DOE requires contractors to develop a "transportation safety document," which identifies what types of transportation accidents could happen and how they could be prevented or mitigated. The DNFSB issued <u>Recommendation 2023-1</u>, <u>Onsite Transportation Safety</u>. In the Recommendation, the DNFSB identified specific concerns at LANL and that DOE needed to improve guidance on developing transportation safety documents.





LANL was not analyzing accidents like a vehicle crash off a steep cliff and did not have adequate safety controls in its transportation safety document. This was particularly concerning given the amount of radioactive material that could be moved in a vehicle and the proximity of the public to the roads at the laboratory.





Building 235-F at SRS is a facility built in the 1950s that supported various nuclear material production and storage missions. All missions were completed in the early-2000s, but a significant quantity of a very hazardous form of plutonium was left behind in the facility. This plutonium could be released in a fire, putting nearby workers and the public in danger. To address this safety issue, DNFSB issued <u>Recommendation</u> 2012-1.



Interior view of a hot process cell in 235-F at SRS during deactivation.



Since issuance of DNFSB's <u>Recommendation 2012-1</u>, Savannah River Site Building 235-F Safety.



DOE eliminated all sources of electrical power from the facility, which substantially reduces the likelihood of a fire.

DOE removed much of the plutonium material that was stuck in shielded hot cells.



Maintaining Disciplined Operations at Defense Nuclear Facilities



After DNFSB's field oversight at the SRS in 2023, site personnel improved how investigators learn and improve from facility mishaps.



Despite advanced safety controls and features, people must still perform operations—they can and do make mistakes—which can cause accidents that release radioactive materials impacting the safety of the public and workers. Structured and disciplined operations at nuclear facilities minimize the likelihood and consequences of human error or technical and organizational system failures.



The DNFSB makes it easy for anyone to submit safety allegations in a confidential *manner.* The DNFSB reviews all safety concerns within its jurisdiction promptly and dispositions them in accordance with veracity and safety significance.

As an example, the DNFSB received multiple concerns from employees at the Pantex Plant about the lack of discipline applied to nuclear explosive operations, the training and qualification program, excessive overtime work, and how management views safety. This is important because workers need to strictly follow procedures to prevent accidents. DNFSB actions included:

- DNFSB reviewed the allegation, confirmed certain issues, and sent a letter to ulletDOE dated June 9, 2021.
- In a response dated <u>August 5, 2021</u>, DOE improved worker training and reinforced expectations on how work is performed to prevent accidents and unnecessary rework at the Pantex Plant.



Work on nuclear weapons at the Pantex Plant.