

Bruce Hamilton, Chairman
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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



February 21, 2020

The Honorable Dan Brouillette
Secretary of Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Brouillette:

On December 17, 2019, the Defense Nuclear Facilities Safety Board received and considered your response to draft Recommendation 2020-1, *Nuclear Safety Requirements*. On February 20, 2020, the Board—in accordance with 42 U.S.C. § 2286d(a)(3)—approved Recommendation 2020-1, which is enclosed for your consideration.

The Board reviewed your response carefully and strengthened several areas of the Recommendation. Notably, the Board decided to remove the fifth sub-recommendation regarding safety basis quality assurance and document control from this Recommendation.

Recommendation 2020-1 is intended to strengthen DOE's regulatory framework in its current form, including DOE's orders, standards, and implementation. The Board agrees with DOE that 10 CFR 830 requires an update, but believes that the Notice of Proposed Rulemaking would actually erode the regulatory framework. DOE's nuclear enterprise has grown since the original issuance of the rule; however, DOE's regulatory framework has not been updated to include requirements for key concepts and safety control strategies upon which your defense nuclear facilities rely. Specifically, the framework lacks sufficient requirements to ensure consistent and appropriate implementation across the complex for unreviewed safety questions, technical safety requirements, specific administrative controls, and the defense-in-depth construct.

The Board understands that DOE has a number of directives and program-specific initiatives to address aging infrastructure. However, DOE does not have a consistent formal process for identifying and performing infrastructure upgrades that are necessary to ensure that structures, systems, and components can perform their safety functions.

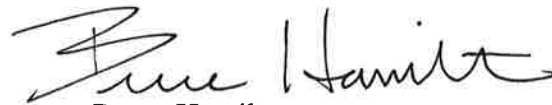
The Administrator of the National Nuclear Security Administration testified to the Subcommittee on Energy and Water Development Senate Committee on Appropriations on April 11, 2018, that "NNSA's infrastructure is in a brittle state that requires significant and sustained investments over the coming decade to correct. There is no margin for further delay in

modernizing NNSA's scientific, technical, and engineering capabilities, and recapitalizing our infrastructure needed to produce strategic materials and components for U.S. nuclear weapons." We agree with the Administrator's statement, but believe that DOE must develop a formal process to address aging infrastructure systematically to ensure adequate protection across the DOE complex.

After you have received this Recommendation, and as required by 42 U.S.C. § 2286d(b), the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public. The Board believes that Recommendation 2020-1, its supporting documentation, and risk assessment contain no information that is classified or otherwise restricted by DOE under the Atomic Energy Act of 1954, as amended. Please arrange to have this Recommendation and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register*.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Yours truly,

A handwritten signature in cursive script, appearing to read "Bruce Hamilton".

Bruce Hamilton
Chairman

Enclosure

c: Mr. Joe Olencz

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY

Nuclear Safety Requirements

Pursuant to 42 U.S.C. § 2286a(b)(5)

Atomic Energy Act of 1954, As Amended

Dated: February 20, 2020

Introduction. The Department of Energy’s (DOE) defense nuclear facilities and associated infrastructure are aging, but DOE will continue to use many of the facilities and much of the infrastructure for the foreseeable future. Consequently, the safety systems and features that were designed into the buildings or installed during construction are also aging. At the same time, DOE is proposing, designing, and building new defense nuclear facilities to support its continued mission. DOE needs to maintain a robust safety posture and strong regulatory framework to ensure that both its aging facilities and infrastructure and its new facilities provide adequate protection of public health and safety. DOE will need clear requirements and guidance for its staff to follow and enforce.

Background. DOE Policy 420.1, *Nuclear Safety Policy*, states, “It is the policy of the Department of Energy to design, construct, operate, and decommission its nuclear facilities in a manner that ensures adequate protection of workers, the public, and the environment.” Title 10 Code of Federal Regulations (CFR) 830, *Nuclear Safety Management*, provides a foundation of requirements upon which DOE relies to ensure adequate protection of workers, the public, and the environment. With this rule, DOE has developed a robust regulatory framework—including orders, guides, and standards—to provide the requirements and guidance for the safe design, construction, operation, and decommissioning of its defense nuclear facilities.

10 CFR 830 captures the fundamental requirements for nuclear safety management to ensure contractors perform work “with the hazard controls that ensure adequate protection of workers, the public, and the environment.” DOE provides additional requirements in orders and standards. These additional requirements may be imposed on contractors by reference in regulations or by contract. DOE also provides non-mandatory guidance in guides, handbooks, and manuals.

In its initial *Notice of Proposed Rulemaking* creating 10 CFR 830¹, DOE noted:

The [Price-Anderson Amendments Act of 1988], coupled with DOE efforts to improve the assurance of safety in its nuclear operations, led DOE to conclude that basic DOE nuclear safety requirements should be established through rulemaking. These requirements would revise and supplement the existing requirements, and in particular, establish specific requirements for applicable DOE nuclear facilities and provide a structured means for measuring the adequacy of the implementation and compliance on a facility-specific basis. Compliance would be measured against specific requirements and against provisions of programs required by these requirements and approved by DOE.

As specified in its enabling legislation, the first function of the Defense Nuclear Facilities Safety Board (Board) is to “review and evaluate the content and implementation of the standards

¹ 56 FR 64316, December 9, 1991.

relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility.”² Since its creation, the Board has provided several recommendations that focus on creating a standards-based safety management system for DOE’s defense nuclear facilities. DOE issued a notice of proposed rulemaking for 10 CFR 830 in August 2018. In this recommendation, the Board recommends to the Secretary of Energy specific measures that DOE should retain or adopt as requirements in its regulatory framework, including 10 CFR 830 and associated orders and standards, to include the implementation thereof, to ensure that public health and safety are adequately protected.

The Board notes a fundamental principle of responsibility and delegation in Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*:

*In any delegation of responsibility or authority to lower echelons of DOE or to contractors, the highest levels of DOE continue to retain safety responsibility. While this responsibility can be delegated, it is never ceded by the person or organization making the delegation. Contractors are responsible to DOE for safety of their operations, while DOE is itself responsible to the President, Congress, and the public.*³

DOE is responsible for designing, constructing, operating, and decommissioning its defense nuclear facilities in a manner that ensures adequate protection of the public. Therefore, DOE prescribes the requirements for its operating contractors to follow and implement, approves the facilities’ safety bases,⁴ and oversees compliance through line management and independent oversight.

Analysis.

Aging Infrastructure—When DOE first issued 10 CFR 830, the majority of its defense nuclear facilities were already a few decades old, and DOE had launched an effort to construct new facilities to replace them. The Replacement Tritium Facility at the Savannah River Site (now known as Building 233-H) is an example. However, nearly three decades after construction and startup of the replacement facility, DOE continues to rely on some older facilities to support its tritium operations, and will continue to do so for the indefinite future.

Similarly, DOE has embarked upon the design and construction of the Uranium Processing Facility at the Y-12 National Security Complex, but intends to operate two associated 50-plus year old facilities for another several decades to support its production commitments for national security purposes. Also, the time from concept to startup of a new defense nuclear facility has increased dramatically in recent years, placing further emphasis on the need for continued operation of aging facilities.

² 42 United States Code (USC) § 2286a(b)(1).

³ Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*. May 21, 2004.

⁴ From 10 CFR 830.3, “Safety basis means the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment.”

As facilities age, concerns develop over whether DOE can still safely operate and maintain them. Safety structures, systems, and components may degrade and not be able to reliably perform their safety functions. Older facilities continue to update their safety bases to comply with 10 CFR 830 without ensuring the reliability of safety systems, comprehensively evaluating the need for refurbishment or replacement of those systems, reconsidering the design or integrity of structures, or conducting a backfit analysis of equipment important to safety. Aging impacts are especially concerning for passive features (e.g., facility structures and fire walls) that are not required to be surveilled to ensure they can perform their safety function. While DOE performs some upgrades and retrofits at aging facilities, it lacks a formal, complex-wide regulatory structure for identifying and performing upgrades necessary for the adequate protection of public and workers.

In addition, as the infrastructure supporting safety systems (e.g., utilities and site services) ages, the supporting infrastructure may also degrade and impact the reliability of safety systems. DOE has taken action to address specific issues at particular sites, such as the Extended Life Program (ELP) at Y-12. However, the Board's concerns about aging infrastructure extend across the complex. Efforts such as the Y-12 ELP are laudable, but a much more systematic approach is required to address the needs across the complex. The Board has previously communicated its concerns regarding age-related degradation of infrastructure.

In a 2018 report⁵, DOE's Infrastructure Executive Committee noted that deferred maintenance had increased by 25 percent between 2013 and 2017 to a total of \$5.9 billion dollars for operational facilities. Also, the report noted that 17 of the Department's 79 core capabilities⁶ were potentially at risk due to inadequate infrastructure, including 5 core capabilities related to defense nuclear facility infrastructure and operation.

The Administrator for the National Nuclear Security Administration (NNSA) recognized the challenges NNSA faces with regards to its aging infrastructure in her April 11, 2018, testimony to the Subcommittee on Energy and Water Development Senate Committee on Appropriations, "NNSA's infrastructure is in a brittle state that requires significant and sustained investments over the coming decade to correct. There is no margin for further delay in modernizing NNSA's scientific, technical, and engineering capabilities, and recapitalizing our infrastructure needed to produce strategic materials and components for U.S. nuclear weapons."

In addition to financial investment, a strong regulatory framework is needed to manage aging infrastructure investments and priorities. Accordingly, the Board believes that DOE needs to review its priorities and establish department-level policy and guidance for managing aging infrastructure.

Hazard Categories—In 10 CFR 830, DOE applies a graded approach to the preparation of the safety basis for defense nuclear facilities, provides the criteria to be used for such gradation, and defines three Hazard Categories grouped by the significance of their

⁵ *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*, March 27, 2018.

⁶ Core capability is defined in DOE Order 430.1C, *Real Property Asset Management*, as the ability to conduct programmatic activities that would be degraded should the asset fail to perform as intended.

consequences to different receptors (i.e., offsite/public, onsite/collocated workers, and local/facility workers). In its proposed revision to 10 CFR 830, DOE proposes to delete the specific definitions of Hazard Categories and replace them with a generic definition in the future.

If it removes the Hazard Category definitions from 10 CFR 830 and the rulemaking process, DOE fundamentally undermines important nuclear safety processes established in the rule. Hazard categorization is an important aspect of 10 CFR 830 because the process determines what safety basis requirements are applicable to a facility. When combined with the lack of an aging management program, this could enable contractors to increase the radiological hazards present in an aging facility without an adequate understanding of the ability of the facility's safety structures, systems, and components to control the higher level of risk.

DOE Approvals—Both DOE and the Board have observed that the current requirement for updating a facility's documented safety analysis on an annual basis has been problematic at some defense nuclear facilities with complex activities. This is compounded when DOE and its contractors defer correcting known deficiencies until the next annual update instead of correcting the deficiencies within the current cycle. The Board also has observed situations where there have been multiple "review iterations" by the contractors and their DOE approval authorities. This could be a sign of disagreement between DOE and its contractor, or the lack of adequate technical quality or content in the safety basis documents submitted to DOE for approval. Difficulties in the annual update process also could indicate that DOE's contractors are not implementing the unreviewed safety question (USQ) process consistent with DOE requirements.

The Notice of Rulemaking does not provide an analysis of the problems that DOE is attempting to address, so it is not clear that DOE's proposed change to remove the requirement for DOE to approve annual documented safety analysis (DSA) updates is an effective solution. Removal of this requirement also complicates DOE's ability to ensure the configuration of the facility, the processes, and the documentation, and to evaluate the cumulative impact of temporary or permanent changes on the safety of the facility. The lack of an annual approval process could result in increasing latent risks as facilities and infrastructure age, due to the reduced frequency of DOE's approval of the evaluation of the reliability of their safety structures, systems, and components. As the Board noted in Recommendation 2004-1, "Contractors are responsible to DOE for safety of their operations, while DOE is itself responsible to the President, Congress, and the public."

Safety Basis Process and Requirements—10 CFR 830 captures the fundamental requirements for nuclear safety management to ensure contractors perform work "with the hazard controls that ensure adequate protection of workers, the public, and the environment." DOE provides additional requirements in orders and standards. These additional requirements may be imposed on contractors by reference in regulations or by contract. DOE also provides non-mandatory guidance in guides, handbooks, and manuals.

DOE uses a number of processes for implementing an approved safety basis. The USQ process determines the approval authority for proposed changes to DSAs. Technical safety requirements (TSR) ensure that important operating parameters are maintained, and that safety structures, systems, and components are available and able to perform their defined safety

functions under all types of conditions. Specific administrative controls (SACs) are higher level administrative controls that have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant.

USQs, TSRs, and SACs are all very important aspects of implementing and maintaining the safety basis at defense nuclear facilities. However, DOE does not provide specific implementation requirements in its regulatory framework, including 10 CFR 830, for contractor implementation of USQs, TSRs, and SACs. Instead, DOE provides non-mandatory guidance for USQ and TSR implementation via guidance documents and some requirements for SACs via a standard.⁷ This lack of implementation requirements leads to inconsistent implementation across the complex. Therefore, the Board concludes DOE should incorporate specific implementation requirements for USQs, TSRs, and SACs, in its regulatory framework, including 10 CFR 830.

The attached *Findings, Supporting Data, and Analysis* document provides the Board's supporting analysis for this recommendation.

Conclusion. DOE needs to have a robust regulatory framework that provides sufficient structure such that both aging and new defense nuclear facilities continue to provide adequate protection of workers and the public. This recommendation is intended to strengthen DOE's regulatory framework in its current form, including DOE's orders, standards, and implementation. The Board agrees with DOE that 10 CFR 830 requires an update, but believes that the Notice of Proposed Rulemaking would actually erode the regulatory framework. DOE's nuclear enterprise has grown since the original issuance of the rule; however, DOE's regulatory framework has not been updated to include requirements for key concepts and safety control strategies upon which its defense nuclear facilities rely.

Recommendation. To ensure adequate protection at defense nuclear facilities, the Board recommends that DOE revise its regulatory framework, to include requirements in 10 CFR 830, *Nuclear Safety Management*, associated orders and standards, and implementation thereof, as follows:

1. **Aging Infrastructure.**

- a. Develop and implement an approach including requirements to aging management that includes a formal process for identifying and performing infrastructure upgrades that are necessary to ensure facilities and structures, systems, and components can perform their safety functions.

2. **Hazard Categories.**

- a. Retain qualitative definitions of hazard categories in 10 CFR 830.
- b. Revise 10 CFR 830 to mandate use of a single version of Standard 1027 when performing facility hazard categorization.


⁷ DOE Standard 1186-2016, *Specific Administrative Controls*, contains requirements; however, those requirements are only enforceable if Standard 1186-2016 is included in a contract.

3. DOE Approvals.

- a. Conduct a root cause analysis to identify the underlying issues prohibiting the current safety basis approval process from working efficiently and use the findings to improve DOE's approval process.
- b. Add language to the rule to explain that DOE's review of safety basis updates should consider the cumulative effect of changes to the safety basis.
- c. Revise the body of 10 CFR 830, Subpart B, to include formal DOE approval of justifications for continued operation and evaluations of the safety of a situation.

4. Safety Basis Process and Requirements.

- a. Conduct a root cause analysis to identify the underlying issues prohibiting contractors from developing and submitting a documented safety analysis on an annual schedule for DOE approval and use the findings to improve the submission process.
- b. While conducting the analyses in 3.a. and 4.a. above, retain the requirement for contractors to submit a documented safety analysis on an annual schedule for DOE approval.
- c. Specify what safety basis documentation a contractor must submit when seeking approval for an action involving a USQ (proposed 10 CFR 830.203(d)).
- d. Establish requirements for USQs and TSRs in 10 CFR 830 and/or orders, by elevating key guidance on USQs and TSRs to clearly identified requirements.
- e. Establish requirements for and incorporate the concept of defense-in-depth and SACs and add a discussion of defense-in-depth and SACs to 10 CFR 830 under safety structures, systems, and components.


Bruce Hamilton
Chairman

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY
Nuclear Safety Requirements
Risk Assessment for Recommendation 2020-1

This risk assessment supports the Defense Nuclear Facilities Safety Board's (Board) Recommendation 2020-1, *Nuclear Safety Requirements*. Board's Policy Statement 5, *Policy Statement on Assessing Risk*, states:

Risk assessments performed in accordance with the Board's revised enabling statute will aid the Secretary of Energy in the development of implementation plans focused on the safety improvements that are needed to address the Board's recommendations.

This recommendation identifies deficiencies with the Department of Energy's (DOE) proposed *Nuclear Safety Management* rule, 10 CFR 830, and with the implementation of the current rule's requirements. Subpart B of the rule, *Safety Basis Requirements*, applies to the highest hazard defense nuclear facilities across the complex. The application of the changes DOE has proposed will have a far-reaching impact on those facilities posing the greatest risks to worker and public health and safety.

The Secretary of Energy is required to ensure adequate protection of the public. DOE established 10 CFR 830 as a fundamental part of the Secretary of Energy's ability to ensure adequate protection. Given the weaknesses in the existing rule and further weaknesses in DOE's proposed rulemaking, the Secretary of Energy cannot consistently ensure adequate protection. Therefore this recommendation is justified and necessary.

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY
Nuclear Safety Requirements
Findings, Supporting Data, and Analysis

Background. The Department of Energy (DOE) developed the first draft of Subpart B to 10 Code of Federal Regulations (CFR) Part 830, *Safety Basis Requirements*, in the mid-1990s using subject matter expertise from the Nuclear Regulatory Commission (NRC). DOE designed its format and contents similar to NRC’s 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities*. To that end, DOE created the concept of a safety basis, which is a series of documents comprising a documented safety analysis (DSA), a technical safety requirements (TSR) document, and a safety evaluation report (SER). DOE would review and approve the contractor developed DSA and TSR documents, and issue the SER to document its review and approval.

To maintain configuration control of the DSA while allowing some operational flexibility for the contractors, DOE established the unreviewed safety question (USQ) process so that contractors could make some changes to their activities as long as the changes were within the bounds of the DOE-approved DSA. Thus, three distinct sections were created in the main body of the rule, with the USQ process dedicated to the configuration control of the DSA; and any changes to the TSR document were to be submitted to DOE for approval prior to implementation. DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents* established DOE’s process for its review and approval activities and the development of the SER.

DOE provided additional details on these concepts in Appendix A to Subpart B as “DOE’s expectations for safety basis requirements of 10 CFR 830, acceptable methods for implementing these requirements, and criteria DOE will use to evaluate compliance with these requirements.” This concept was also modeled on NRC’s issuance of appendices to “establish minimum requirements” that need to be met in order to comply with 10 CFR 50. For example, Appendix A to Part 50 provides the general design criteria and Appendix R provides fire protection requirements. Neither NRC nor DOE intended to consider the contents of an appendix to a Code of Federal Regulations section to be subject to the users’ discretion. NRC provided additional detailed guidance in the regulatory guides that utilities use to comply with Part 50. Similarly, DOE provided a list of standards in Appendix A to Part 830 that contractors should use as acceptable methodologies for compliance with 10 CFR 830, Subpart B. These are known as the safe harbor standards.

Introduction. As part of the DOE’s regulatory reform activities under Executive Order 13777, *Enforcing the Regulatory Reform Agenda*, DOE directed its Office of Environment, Health, Safety and Security¹, working with the Office of the General Counsel, to initiate a rulemaking to revise 10 CFR 830 to address the following areas (amongst others):

- a. ***Regulatory Treatment of Hazard Category 3 Facilities.*** *Differentiate the treatment of Hazard Category 2 and Hazard Category 3 nuclear facilities by developing a new*

¹ Memorandum from Dan R. Brouillette, Deputy Secretary, to heads of elements, *Initiate a Rulemaking to Revise 10 CFR 830*, dated August 15, 2017.

subpart to 830 for Hazard Category 3 that provides an appropriate graded approach to the implementation of the requirements in 830 for both contractors and the Department.

- b. **Safe Harbor Standards.** Table 2 of Appendix A of 10 CFR 830, Subpart B, should be removed from the rule and become a separate standard (or other mechanism) referenced in the Rule.*
- c. **Standard 1027 (STD) Successor Document.** Add the term ‘or successor document’ to the 10 CFR 830 requirement to categorize nuclear facilities consistent with DOE STD 1027-92. The [working] Team recommends that DOE initiate a new revision to DOE STD 1027 (in addition to the existing 1027-92 revision effort) that updates the hazard categorization methodology and can be synched with the eventual revision to 830.*
- d. **Updates to Documented Safety Analyses (DSAs).** Increase the periodicity from the existing annual requirement to either 2 or 3 years; the current (arbitrary) annual requirement is problematic for complex facilities (e.g., the DOE review/approval can take several months and overlap with contractor delivery of the annual update for the subsequent year). In addition, appropriately scoped updates should not require DOE approval.*
- f. **Unreviewed Safety Question (USQ).** Set appropriate USQ approval levels, improving operational flexibility, and clarifying terminology.*
- g. **Limiting Analyses of Chemical Hazards.** Limiting the requirement for the analysis of chemical hazards in DSAs, unless the chemicals, for example, are an initiator to a nuclear event, or inhibit responses to nuclear events. [Note: chemical hazards are already addressed in 10 CFR 851, Worker Safety and Health Program.]*

These activities were to “result in significant improvements in efficiency and/or decrease in cost in Laboratory and DOE operations, while maintaining accountability and contractor performance standards [and] an appropriate level of DOE oversight.”

Findings. DOE issued the notice of proposed rulemaking for 10 CFR 830 in August 2018. The following paragraphs provide the Board’s findings and analysis of DOE’s proposed changes to 10 CFR 830, Subpart B, *Safety Basis Requirements*, and its referenced documents.

1. Aging Infrastructure.

DOE’s memorandum that initiated the rulemaking relied on input and proposals from a working group to “identify internal DOE reforms that could result in significant improvements in efficiency and/or decrease in cost...while maintaining accountability and contractor performance standards.” From the working group’s proposal, DOE identified several focus areas, including reform of 10 CFR 830, for further development of actions that may achieve the goal of improving efficiency and decreasing cost. This effort did not identify issues with the aging

infrastructure, including lack of DOE guidance or requirements for maintenance, or the adequacy of safety posture for indefinite continued operation.

It is clear that as defense nuclear facilities age, their safety bases will become more complex. In some cases, DOE introduced new missions into old facilities, which are dependent upon dated technological infrastructure. Complexity has been shown to drive the contractors to heavily rely on administrative controls, instead of engineered features, to overcome the inherent difficulties involved in trying to comply with the requirements of 10 CFR 830, Subpart B.

At the time when 10 CFR 830 was crafted, the majority of defense nuclear facilities were only a few decades old, and DOE had launched an aggressive effort to construct new facilities to replace them. Facilities such as the Replacement Tritium Facility (RTF, now known as Building 233-H) at the Savannah River Site were examples of this vision in the early 1990s. However, three decades after the construction and startup of RTF, DOE continues to rely on some older facilities to support its tritium operations for the indefinite future. Similarly, DOE embarked upon design and construction of the Uranium Processing Facility at the Y-12 National Security Complex, but plans to continue to rely on operation of two other 50-plus year old facilities for another several decades to support its production commitments for national security purposes.

A significant number of defense nuclear facilities in the complex are now more than 50 years old and have surpassed their design life by decades. Concerns over whether facilities can still be operated and maintained safely develop as facilities age. Safety structures, systems, and components may degrade and be unable to perform their safety functions reliably. As the infrastructure supporting those safety systems (e.g., passive features, utilities, and site services) ages, it may also degrade and impact the reliability of those safety systems.

As facilities age, concerns develop over whether DOE can still safely operate and maintain them. Safety structures, systems, and components may degrade and not be able to reliably perform their safety functions. Older facilities continue to update their safety bases to comply with 10 CFR 830 without ensuring the reliability of safety systems, comprehensively evaluating the need for refurbishment or replacement of those systems, reconsidering the design or integrity of structures, or conducting a backfit analysis of equipment important to safety. Aging impacts are especially concerning for passive features (e.g., facility structures and fire walls) that are not required to be surveilled to ensure they can perform their safety functions. While DOE performs some upgrades and retrofits at aging facilities, DOE lacks a formal, complex-wide regulatory structure for identifying and performing upgrades necessary for the adequate protection of public and workers.

In addition, as the infrastructure supporting safety systems (e.g., utilities and site services) ages, the supporting infrastructure may also degrade and impact the reliability of safety systems. DOE has taken action to address specific issues at particular sites, such as the Extended Life Program (ELP) at Y-12. However, the Board's concerns about aging infrastructure extend across the complex. Efforts such as the Y-12 ELP are laudable, but a much more systematic approach is required to address the needs across the complex. The Board has previously communicated its concerns regarding age-related degradation of infrastructure. For example, in prior communications the Board has expressed concerns with age-related degradation in:

- General-service water distribution systems that provide water to safety-significant or safety-class fire suppression systems;
- General-service electrical distribution systems that could impact the reliability of safety-significant confinement ventilation systems; and
- Building structures and internal systems that cannot withstand the seismic loads required to meet their designated performance categories.²

In a 2018 report³, DOE’s Infrastructure Executive Committee noted that deferred maintenance had increased by 25 percent between 2013 and 2017 to a total of \$5.9 billion dollars for operational facilities, and that 17 of DOE’s 79 core capabilities⁴ were potentially at risk due to inadequate infrastructure (see Table 1 for examples).

Table 1. *Core Capabilities Potentially at Risk Due to Infrastructure Deficiencies⁵*

Core Capability	Replacement Plant Value⁶ assessed as Inadequate
Decontaminate and Decommission Facilities and Infrastructure	74%
Uranium	45%
Nuclear Material Accountability, Storage, Protection, and Handling	43%
Plutonium	40%
Weapons Assembly/Disassembly	36%

In recognition of the general situation of aging infrastructure in DOE and its potential impacts on the defense nuclear facilities, the Board is concerned that DOE needs to review its priorities and establish department-level policy and guidance for managing the aging infrastructure supporting those facilities.

² See Board correspondence dated March 13, 2007; February 6, 2009; September 10, 2010*; September 30, 2011*; March 27, 2012; October 31, 2012*; February 25, 2013; October 30, 2013*; February 4, 2015; October 29, 2015; December 16, 2015; May 11, 2017; September 7, 2018; and July 2, 2019. The four dates with an asterisk are annual aging infrastructure reports the Board issued to Congress and forwarded to DOE. The dates are from the cover letter forwarding the report to DOE.

³ *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*; March 27, 2018.

⁴ Core capability is defined in DOE Order 430.1C, *Real Property Asset Management*, as the ability to conduct programmatic activities that would be degraded should the asset fail to perform as intended.

⁵ Data is from Table C of *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*; March 27, 2018.

⁶ Replacement Plant Value (RPV) is defined in DOE Order 430.1C, *Real Property Asset Management*, as the cost to replace the existing structure with a new structure of comparable size using current technology, codes, standards, and materials.

DOE has not conducted a comprehensive analysis of the difficulties facing its aging infrastructure at defense nuclear facilities. Without this analysis, DOE's efforts will not address the fundamental reasons for increased cost or other difficulties of maintaining old facilities in operational condition; nor will it assess the reduction in their margin of safety that may occur as the facilities age.

DOE needs to evaluate the state of its aging facilities, identify their required operational life to meet their mission needs, and develop an integrated plan for replacement or refurbishment of those facilities to maintain their safety posture and ensure adequate protection of the public, the workers, and the environment. DOE does not have any DOE-wide policies, directives, or requirements in place for implementing an effective aging management program. Accordingly, DOE needs to develop requirements and criteria for dealing with its aging infrastructure.

2. Hazard Categories.

Definition of Hazard Categorization—In 10 CFR 830, DOE requires application of a graded approach to the preparation of DSAs and provides the criteria to be used for such gradation in Section 830.3 of Subpart B. Table 1 in Appendix A to Subpart B defines three hazard categories that are grouped by the significance of their consequences to different receptors (i.e., offsite/public, onsite/collocated workers, and local/facility workers).

In the proposed revision to 10 CFR 830, DOE deletes Table 1 and the specific definitions of hazard categorization, and states that it intends to provide a generic definition in the future that is not described at this time. DOE Standard 3009, safe harbor for preparation of a DSA, is formulated using the concept provided in Table 1 of the existing Subpart B. By removing the definitions of hazard categories from Part 830 and the rulemaking process, DOE's proposed revisions fundamentally undermine important nuclear safety processes established in the rule.

Hazard categorization is a fundamental element of the safety basis requirements of 10 CFR 830 because the process determines whether the safety basis requirements of Subpart B are applicable to a facility. Based on the definition of hazard categories provided in Table 1, DOE referred to Standard 1027⁷ and mandated its use in Section 830.202 of the rule because "DOE want[ed] contractors to be consistent when determining the hazard classification for its nuclear facilities, hence we are requiring the consistent use of DOE-STD-1027 which has an established history for this purpose."⁸ DOE's proposed action to delete Table 1, without any detailed discussion regarding hazard categorization, and deferring to a future document to be developed:

- Lacks the "established history" and a roadmap for preparation and implementation of the replacement approach;

⁷ DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*; Change Notice 1, September 1997.

⁸ Preamble to 10 CFR 830, Section III, *Response to Comments on the Interim Final Rule*, response to Comment N.

- Does not provide the rationale for such a significant change in approach, which has been practiced for more than two decades without known degradation or deficiencies in implementation of nuclear safety requirements;
- Creates an ambiguous and unclear domain of standards to be developed for compliance with nuclear safety requirements; and
- Undermines the fundamental principles of the graded approach and its implementation as described in the rule.

Reference to Standard 1027 Within the Rule—DOE’s memorandum to initiate the rulemaking recommended adding the phrase “or successor document” to 10 CFR 830.202(b)(3) and to “initiate a new revision [to Standard 1027] that updates the hazard categorization methodology.”

DOE prepared Standard 1027 in 1992 to provide guidance on hazard categorization and on the performance of hazard analyses for preparation of safety bases for nonreactor nuclear facilities. It used the available technical information to develop screening criteria and grouping of the nuclear facilities based on their potential consequences to the immediate workers, site area, and offsite members of the public. DOE also based Standard 1027 on a survey of all DOE nuclear facilities and their potential hazards to arrive at a set of parameters that would realistically categorize those facilities based on their potential consequences. More updated technical information and recommendations by the International Commission on Radiological Protection (ICRP)^{9, 10} has resulted in some changes to those parameters. It would be prudent, and technically justified, to use the most up to date information in a DOE standard that is fundamental for graded implementation of nuclear safety requirements at defense nuclear facilities.

This DOE action, combined with the deletion of Table 1 from the rule that defines hazard categories, and deferring a new definition to be provided outside the rulemaking process, will create an uncertain, ambiguous, and unclear methodology for implementation of 10 CFR 830 at the defense nuclear facilities; and consequently, a potential for eroding the level of protection currently provided by those facilities.

Additionally, both the existing version and the proposed revision of 10 CFR 830 state that a contractor must “categorize the facility consistent with” Standard 1027 rather than “in accordance with” Standard 1027. The words “consistent with” introduce flexibility in implementation to not actually follow the requirements in Standard 1027. This language has already led to the National Nuclear Security Administration (NNSA) issuing supplemental

⁹ ICRP 68, 1994, *Dose Coefficients for Intakes of Radionuclides by Workers*, Replacement of ICRP Publication 61, International Commission on Radiological Protection, Pergamon Press, Oxford, Great Britain.

¹⁰ ICRP 72, 1995, *Age-Dependent Doses to Members of the Public from Intake of Radionuclides*, Part 5, Compilation of Ingestion and Inhalation Dose Coefficients, International Commission on Radiological Protection, Pergamon Press, Great Britain.

guidance to its facilities to use a modification¹¹ to Standard 1027 that is not cited by the rule and, therefore, not used by the Office of Environmental Management; resulting in an inconsistent gradation of defense nuclear facilities in the complex.

The safety basis requirements in Subpart B apply to Hazard Category 1, 2, or 3 nuclear facilities. With DOE's proposed revisions, 830 would not include any language that defines these terms, and DOE can change the definitions of these terms outside the rulemaking process.

3. Submission and Approval of Safety Bases.

Need for Root Cause Analysis and DOE Approval of Annual Updates to the DSA—The DOE memorandum that initiated the rulemaking directed DOE elements to “increase the periodicity from the existing annual requirement to either two or three years; the current (arbitrary) annual requirement is problematic for complex facilities. In addition, appropriately scoped updates should not require DOE approval.” In accordance with the memorandum, the notice of proposed rulemaking deletes the requirement for DOE review and approval of the annual updates to the DSAs. This DOE action weakens the safety basis construct created by DOE in establishing Subpart B. DOE required the preparation of safety basis for nuclear facilities to ensure that adequate protection of the public and the workers is implemented through compliance with its safe harbor standards. It also weakens the USQ process, which ensures that the safety bases are maintained under a defined configuration control program.

The Board has noted that some defense nuclear facilities with complex activities have difficulty meeting the annual update commitments. Although this was not anticipated by DOE at the time when 10 CFR 830 was issued in January 2001¹², some sites rely on inter-related documents that comprise their safety bases and it might be difficult to ensure that the various elements of their safety bases are updated consistently in the allowed time.¹³

The Board has also observed situations where there have been multiple “review iterations” by contractors and their DOE approval authorities. This could be a sign of disagreement between DOE and its contractor, or the lack of adequate technical contents of the DSAs submitted to DOE for approval. Difficulties in submitting an annual update also could indicate that DOE's contractors are not implementing the USQ process consistent with the requirements.

DOE's notice of rulemaking does not identify the problems that DOE is attempting to address, so it is not clear that DOE's proposed change is an appropriate solution. It would be prudent for DOE to evaluate the reasons why contractors and DOE experience significant challenges implementing the annual requirement. DOE needs to conduct a root cause analysis to determine why DOE and its contractors are having difficulties managing the review and approval

¹¹ NNSA Supplemental Guidance 1027, *Guidance on Using Release Fraction and Modern Dosimetric Information Consistently with DOE STD 1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.*

¹² 66 FR 1810, DOE response to Comment JJ, Section III of the final Rule, 10 CFR 830: “If the USQ process has been followed properly, the annual approval of the documented safety analysis should require minimal effort.”

¹³ For example, the Board has corresponded on PF-4 at LANL, Pantex, and the Tritium Facilities at the Savannah River Site among others.

of annual updates, and use the results of that analysis to fix the underlying problems. While conducting the analysis, DOE should retain the requirement for contractors to develop and submit safety bases on an annual schedule for DOE approval.

In the revised Appendix A to Subpart B, DOE proposes language to clarify that it will continue to review the DSA updates in some cases, and may even approve the annual update in some cases. The proposed language states, “DOE will review each documented safety analysis...if DOE has reason to believe a portion of the safety basis has substantially changed.” Another relevant new sentence is: “If additional changes are proposed by the contractor and included in the annual update that have not been previously approved by DOE or have not been evaluated as a part of the USQ process, DOE must review and approve these changes.” DOE’s notice of rulemaking does not include a detailed discussion of these changes, and therefore they do not alleviate concerns with removing DOE’s approval of the annual update.

Temporary Authorization of Activities—10 CFR 830.202(g)(3) requires contractors to “Submit the evaluation of the safety of the situation to DOE prior to removing any operational restrictions initiated to meet [safe condition]” of the facility. Those operational restrictions (or other compensatory measures) may continue to be required for a long period of time. Per DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, the vehicle for operating under restrictions for “an extended period of time” until the next annual update of the DSA is issued, is the justification for continued operations (JCO), which is a “temporary change to the facility safety basis.” The DOE guide states that the contractor should submit the JCO to DOE for approval. However, the rule does not formally require DOE’s approval of a JCO.

In some cases, contractors eventually incorporate the operational restrictions and accompanying analyses (or some revised version of them) into the DSA via the annual update. In other cases, JCOs continue to be a stand-alone part of the safety basis for several years. With DOE’s proposed revision to the rule, i.e., not requiring DOE approval of the annual updates to the DSA, there will be important changes to the safety basis with no requirement for their approval by DOE.

Instead of a JCO, contractors may prepare an evaluation of the safety of the situation (ESS) that includes operational restrictions. DOE Guide 424.1-1B states that DOE should approve ESSs for potential inadequacies of the safety analysis (PISAs) that represent a positive USQ; however, the rule does not require DOE approval for this situation. Under DOE’s proposed revision to the rule, the ESS can represent a mechanism for the contractor to make important changes to the safety basis without any requirement for DOE approval.

4. Safety Basis Process and Requirements.

Fundamental Elements of Safety Bases—Unlike the safe harbors for DOE nonreactor nuclear facilities and nuclear explosive facilities for compliance with the DSA requirements of the rule, the rule does not provide any standards for compliance with USQs or TSRs; instead, it refers to DOE guides on those subjects, DOE Guide 424.1-1B and DOE Guide 423.1-1B, *Implementation Guide For Use In Developing Technical Safety Requirements*, respectively.

DOE guides, however, “describe[s] acceptable, non-mandatory means for meeting requirements.” As a result, contractors’ implementation at the sites are diverse and inconsistent. The Deputy Secretary identified this issue in his memorandum as one to be addressed in the proposed rule. The Board has made similar observations that include lack of uniformity of implementation, and in some cases, inconsistency of implementation with the requirements of the rule.

Requirements Regarding the USQ Process—DOE Guide 424.1-1B provides an example of guidance on USQs that should be examined for elevation to a requirement and inclusion in Subpart B. The guide includes expectations on the timeliness with which contractors process PISAs:

It is appropriate to allow a short period of time (hours or days but not weeks) to investigate the conditions to confirm that a safety analysis is potentially inadequate before declaring a PISA....If it is immediately clear that a PISA exists, then the PISA should be declared immediately¹⁴.

This timeliness is important for safety, as it causes the contractor to formally declare a PISA and take actions to place the facility in a safe condition. Contractors do not always perform this step in a timely manner (i.e., within hours or days, but not weeks). This leads contractors to delay implementing the necessary compensatory measures to place or maintain the facility in a safe condition that provides adequate protection of the public. There are instances where contractors have delayed a PISA declaration beyond hours or days because they deemed the information to be not yet mature enough to merit that action. The DOE guidance quoted above already addresses this situation, saying that the contractors may take hours or days to investigate, but not weeks. It should be noted that a similar statement was made in resolution of comments received for the final rulemaking of 10 CFR 830: “the contractor’s USQ procedure should define the period for performance of a USQ determination related to a PISA and that time period should be on the order of days, not weeks or months.” However, not all contractors’ procedures comply with this expectation.

DOE should formalize this guidance on timeliness into a requirement, to ensure that contractors place facilities into safe conditions when they discover PISAs. If DOE believes it is necessary to make some allowance for delaying action because the new information is immature, DOE should provide the criteria for defining “information maturity.” Declaring the information as “immature” and not declaring a PISA should be exceptional and subject to compliance with DOE criteria. Such criteria, however, do not exist and need to be developed.

Additionally, the Board has observed that some contractors allow themselves a “grace period” to take action and return the facility into compliance with their safety bases without declaring a PISA.¹⁵ As a result, the facility would be operating outside of its approved safety basis for the duration of the grace period without DOE knowledge or approval of the situation,

¹⁴ DOE Guide 424.1-1B, Section C.2.

¹⁵ Board Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, February 20, 2019.

and without having to take safety precautions to put the facility in a safe configuration. Section 830.202, Subpart B, does not allow this action, which may result in unsafe operation of defense nuclear facilities and a lack of adequate protection of the public.

Several of the USQ procedures approved by DOE lack any requirements for training and qualification of USQ screeners. These individuals are the first line of defense against lack of compliance with the requirements of the rule, and their knowledge of the facility and its safety basis, as well as the USQ process, is of utmost importance. While preparation of safety bases throughout the complex has created a wealth of knowledgeable subject matter experts that the contractors rely on, implementation of USQ procedures and USQ screening sometimes relies on available personnel, making their training and qualification an important aspect of the safety of operations.

The definition of USQ in the rule also warrants clarification. The proposed (and also existing) definition for USQ in Section 830.3 uses the term “equipment important to safety.” This term is not defined in 10 CFR 830, though it is defined in DOE Guide 424.1-1B. Proper and consistent implementation would be better achieved if the definition from the guide were also included in the rule.

Finally, 10 CFR 830 does not specify what documentation a contractor is required to submit to DOE prior to obtaining approval for planned actions involving a USQ. Specifically, section 830.203(d) states, “A contractor responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility must obtain DOE approval prior to taking any action determined to involve a USQ.” This section does not specify whether a contractor must submit planned changes to the safety basis, a description of planned changes, or if no documentation is required and a verbal explanation would suffice. Accordingly, when DOE approves contractor action, it is not clear that DOE is specifically approving any planned changes to the safety basis.

Requirements Regarding TSRs—DOE Guide 423.1-1B includes some aspect of the content of TSR documents that should be considered for elevation to the rule. In Appendix C to the Guide, DOE combines the Section 830.201 requirement for the contractor to “perform work in accordance with the DOE-approved safety basis” with the quality assurance requirements in Subpart A of the rule. From these two portions of the rule, DOE derives a need for the contractor to “independently confirm the proper implementation of new or revised safety basis controls.” This is an important concept for ensuring safe operation of the facility, and should be directly included in the rule.

One area of difficulty for contractors preparing TSRs has been in the determination of “completion times.” TSRs typically define actions the contractor will take when safety structures, systems, and components (SSC) do not meet their limiting conditions for operation. This scenario can occur intentionally due to a maintenance outage, or unintentionally due to degradation of a safety-related SSC. TSRs define the required times (completion times) by which the contractor must take temporary actions to compensate for the loss of safety SSCs, or by which the contractor will restore SSCs. According to the guide, when developing completion times, the contractor should consider “the safety importance of the lost safety function” and “the risk of continued operations.” In practice, some completion times appear excessively long, with

no documented consideration of safety risk for DOE's review and acceptance. DOE should revise Appendix A to Subpart B to include the concept that safety risks should be considered when developing completion times.

Similarly, some contractors have prepared TSR documents that the action to be taken, when a safety SSC is inoperable or found to be unavailable, is simply to submit to DOE a "recovery plan." Some of these recovery plans are open-ended, without any completion date or compensatory measures in place to achieve an equivalent level of safety as provided in the TSR. As a result, some defense nuclear facilities could be operating outside the bounds of their approved safety basis, relying on an approved "recovery plan" to be completed by some unspecified date. Such situations warrant explicit requirements in the rule to prevent nuclear facilities from operating with less than adequate levels of safety.

Fundamental Nuclear Safety Principles—10 CFR 830 provides the requirements for identification and analysis of hazards, identification of controls, and the quality assurance that must be applied to all stages of nuclear facility operations. However, it does not require implementation of the most fundamental nuclear safety principle, defense-in-depth, to ensure that no one layer of control is solely relied on for safety.

In a letter to the Deputy Secretary of Energy, dated July 8, 1999, the Board stated:

Current requirements for nuclear safety design, criticality safety, fire protection and natural hazards mitigation are set forth in DOE Order 420.1, Facility Safety. This Order (Section 4.1.1.2), when contractually invoked, requires that:

'Nuclear facilities shall be designed with the objective of providing multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment.'

This "defense-in-depth" approach is the hallmark of nuclear facility and process designs.

DOE Order 420.1C, *Facility Safety*, includes an expanded discussion of what the defense-in-depth concept entails. However, the requirements of Order 420.1C are not applied to the operation of existing defense nuclear facilities unless DOE's contract with the management and operating contractor has specifically identified and stipulated its application. As a result, DOE does not routinely implement the defense-in-depth concept to ensure safe operation of nuclear activities. The controls identified in DSAs for existing facilities are usually a compilation of the existing controls, and rarely have led to the identification of new controls for ensuring that multiple layers of protection exist to defend against the release of radioactive materials. This weakness is more common when contractors rely on SACs to compensate for the lack of a safety-related engineered feature to prevent or mitigate an event.

10 CFR 830, Subpart B, needs to require the defense-in-depth construct to ensure that all nuclear facilities and activities meet this fundamental nuclear safety construct, and provide

adequate protection of the public and the workers such that no one failure of a layer of protection would lead to the release of radioactive materials.

Specific Administrative Controls—DOE created the concept of the SAC in response to the Board’s Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*. To provide guidance on this topic, DOE created a new standard, *Specific Administrative Controls*, and revised several other standards and guides to ensure consistency. SACs are a higher level administrative control that have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant. For this reason, SACs are an important tool for DOE to ensure adequate protection

Although DOE created a new standard for SACs, DOE did not revise 10 CFR 830 to reflect the concept of implementing SACs as an equivalent TSR control. As a result, the discussion in 10 CFR 830 on safety controls is incomplete and does not fully reflect current DOE terminology and practice. Accordingly, DOE should include the concept of SACs within the requirements of 10 CFR 830, Subpart B.