RECOMMENDATION 2020-1 PUBLIC MEETING: Recommendation Overview

Chris Roscetti, *Technical Director*

December 4, 2020

Public Meeting Agenda

- Recommendation 2020-1 Overview
- Sub-recommendation 1, Aging Infrastructure
- Sub-recommendation 2, Hazard Categories
- Sub-recommendation 3, DOE Approvals
- Sub-recommendation 4, Safety Basis Process and Requirements
- Summary

Background

- DOE is responsible for ensuring its defense nuclear facilities are designed, constructed, operated, and decommissioned in a manner that provides adequate protection of the public.

- DOE prescribes the requirements for its contractors to follow, approves the facilities' safety bases, and oversees compliance through line management and independent oversight.

- 10 CFR 830, *Nuclear Safety Management*, is the foundation of DOE's regulatory framework for ensuring the health and safety of the public.

- In 2018 DOE undertook a revision of 10 CFR 830.

Recommendation 2020-1

- DOE defense nuclear facilities have grown older and more complex since the rule was issued, but DOE is relaxing rather than reinforcing its regulatory framework.
- There have been recurring problems in developing, reviewing, and approving safety bases, but DOE eliminated requirements instead of addressing causes.
- DOE is not incorporating key concepts and important lessons learned from the past twenty years.
- The Board concludes the revised rule is part of a broader erosion in DOE's nuclear safety framework.

Timeline

- **August 8, 2018**: DOE publishes intent to change 10 CFR 830
- **October 5, 2018**: DNFSB comments on draft rule
  - Public comment and Board letter to DOE
- **October 16, 2019**: Board transmits draft recommendation
- **December 19, 2019**: DOE transmits response to draft
- **February 21, 2020**: Board transmits final recommendation
- **June 11, 2020**: DOE transmits response and draft final rule
- **September 25, 2020**: Board issues letter on DOE response
- **October 19, 2020**: DOE publishes final 10 CFR 830

Recommendation 2020-1

Recommendation 2020-1 is intended to

- **Strengthen DOE's regulatory framework**
- **Maintain and improve federal accountability mechanisms**
- **Maintain and improve fundamental nuclear safety processes**

Four Sub-recommendation areas

- Aging Infrastructure
- Hazard Categories
- DOE Approvals
- Safety Basis Process and Requirements

RECOMMENDATION 2020-1 PUBLIC MEETING: Aging Infrastructure

Douglas Minnema, PhD, CHP, *Technical Staff*

December 4, 2020

Background

- In 2019, DOE reported that:
  - Five core capabilities for defense nuclear facility operation are potentially at risk from aging infrastructure.
  - Deferred maintenance in operational facilities "hovered around $6B for the past five years," annual operating and maintenance costs were $2.2B.
- "DOE facilities currently have an average age of 37 years and the systems that support these facilities (water, sewage, electrical, paved areas, etc.) have an average age of 40 years." (DOE, 2018)

Hanford PUREX Tunnel, May 2017

Background (cont.)

- The Board has identified and communicated numerous issues related to age-related degradation at DOE sites. Examples are:
- Savannah River Site:
  - Tritium Facilities, H-Canyon, Tank Farms, A- and K-Area, Building 235-F
- Y-12 National Security Complex:
  - Building 9204-2E and 9215 Complex
- Pantex:
  - High Pressure Fire Loop
- Hanford Site:
  - Tank farms, 242-A Evaporator, T-Plant and site-wide electrical infrastructure

Specific Sub-recommendation

- ***Sub-Recommendation 1a*** *– 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.*

DOE Response to Sub-Recommendation 1

- DOE stated that it partially accepted the sub-recommendation.
- DOE rejected the recommended action.
- DOE stated they "will ensure that nuclear safety is appropriately considered within **existing organizations and committees** in the Department **who are charged with establishing Department-wide priorities and providing recommendations regarding infrastructure**." (Emphasis added.)
- DOE also indicated that it is involved in the development of ANS-3.14-202x, *Process for Aging Management and Life Extension of Nonreactor Nuclear Facilities*.

Key Roles in Infrastructure Management

- The DOE Office of Management establishes policy and guidance to improve DOE's real property asset management.
- The DOE Senior Real Property Officer monitors DOE's real property assets consistent with requirements, agency goals, objectives. The SRPO is supported by:
  - The Facilities and Infrastructure Steering Committee (FISC) assists in developing and implementing real property asset management strategic goals and initiatives.
  - The Infrastructure Executive Committee (IEC) analyzes the status of DOE's general purpose infrastructure.
  - The Excess Contaminated Facilities Working Group (ECFWG) is responsible for a biennial report to Congress on excess facilities.

Current Staff Assessment

- The Board's staff reviewed charters, agendas, and reports:
  - FISC meets regularly.
  - IEC met regularly and developed annual reports on the state of DOE's general purpose infrastructure until October 2019. At that time the Laboratory Operations Board "indicated that the infrastructure reports had run their course and that the LOB no longer needed them."
  - ECFWG meets as necessary to prepare a biennial report to Congress, *Plan for Deactivation and Decommissioning of Nonoperational Defense Nuclear Facilities*, required by the NDAA for FY2016.
  - All committees developed agendas, none maintained minutes.
- The Board's staff concluded the organizations and committees provide status information but do not formally advise on priorities or methodologies for managing aging infrastructure.

Summary

- Department-wide directives do not establish requirements or ensure a consistent approach for managing aging infrastructure within DOE.
- Program offices appear to have instituted infrastructure management programs; the staff will continue to evaluate those programs.
- Other agencies with responsibility for nuclear safety, such as the NRC and the IAEA, have explicit requirements and guidance for aging management programs.
- **The Board's concern remains. DOE lacks a formal, complex-wide regulatory structure for identifying, prioritizing, and performing upgrades necessary for the adequate protection of public and workers.**

RECOMMENDATION 2020-1 PUBLIC MEETING: Hazard Categorization

Michael Dunlevy, PE, *Technical Staff*

December 4, 2020

Background

- DOE groups facilities based on the severity of potential radiological accidents.
- DOE uses this grouping to apply a graded approach to safety analysis development.

A DOE nuclear facility categorized as	Has the potential for
Hazard category 1	Significant off-site consequences
Hazard category 2	Significant on-site consequences beyond localized consequences
Hazard category 3	Only local significant consequences
Below category 3	Only consequences less than those that provide a basis for categorization as a hazard category 1, 2, or 3 nuclear facility

Higher hazard ↑

Table 1: Hazard Categorization Description as Documented in 10 CFR 830 [2001 version]

Background (cont.)

10 CFR 830: 2001 version

- A contractor must "categorize the facility consistent with DOE-STD-1027-92 [Change Notice 1]."
  - DOE allows the use of multiple hazard categorization standards as long as DOE deems the methodologies consistent with DOE Standard 1027-92.

10 CFR 830: 2018 Draft Rule

- Changed language to: categorize the facility consistent with DOE-STD-1027-92 [Change Notice 1], **or successor document.**
- Removed qualitative hazard categorization definitions [Table 1 from previous slide].

Specific Sub-recommendations

- ***Sub-Recommendation 2a*** *– Retain qualitative definitions of hazard categories in 10 CFR 830.*
  - DOE could have changed hazard category definitions without further rulemaking or public comment.

- ***Sub-Recommendation 2b*** *– Revise 10 CFR 830 to mandate use of a single version of Standard 1027 when performing facility hazard categorization.*
  - Adding "or successor document" could have allowed DOE to change the hazard categorization methodology without further rulemaking.
  - Allowing the use of multiple versions of DOE Standard 1027 could result in an inconsistent and inappropriate gradation of facilities.

Current Status

DOE Response

- DOE rejected sub-recommendation 2a and 2b because “DOE is considering this matter in the current rulemaking.”

10 CFR 830: 2020 Final Rule

- DOE removed qualitative hazard categorization definitions.
- Retained the requirement to categorize a facility consistent with DOE Standard 1027-92.

10 CFR 830: 2020 Final Rule Supplementary Information

- “DOE intends to incorporate any future changes to hazard categorization through the rulemaking process.”
- “if substantive changes are made to DOE-STD-1027-92, CN1, DOE would conduct a rulemaking to update the reference…”

Staff Assessment

- The final rule and supplementary information partially addressed the sub-recommendation.
  - Addressed specific concerns with the language of 10 CFR 830.
  - Concerns with implementation of hazard categorization standards remain.

- The Board's staff identified significant deficiencies, inconsistencies, and non-conservatisms between the different versions of the hazard categorization standards DOE uses.
  - Deficiencies may result in inappropriate facility hazard categorization, which could lead to the development of inadequate control sets to protect the public.

Inconsistencies in Hazard Categorization Standards

- DOE Standard 1027-92 Change Notice 1.
  - Referenced by 10 CFR 830; other standards MUST use a methodology consistent with this version.
- NNSA Supplemental Directive 1027 Admin Change 1.
  - Nonconservatively changed hazard category (HC)-2 and HC-3 threshold quantity (TQ) derivation methodologies.
- DOE Standard 1027-18 Change Notice 1.
  - HC-2 TQ derivation methodology consistent with DOE Standard 1027-92.
  - Nonconservatively changed HC-3 TQ derivation methodology.

Summary

- The Board recommended DOE retain definitions of hazard categories in 10 CFR 830 and to mandate the use of a single version of Standard 1027 for facility hazard categorization.

- DOE rejected the sub-recommendations, but partially addressed the issue in the final version of 10 CFR 830.

- **Hazard categorization implementation concerns exist due to deficiencies, inconsistencies, and non-conservatisms in the multiple standards used by DOE.**

RECOMMENDATION 2020-1 PUBLIC MEETING: DOE Approvals

Jason Anderson, *Technical Staff*

December 4, 2020

Background

- 10 CFR 830 requires DOE's contractors to annually submit an updated DSA (or otherwise state there have been no changes).
- In the 2020 revision to 10 CFR 830, DOE eliminated the requirement for DOE to approve the annual update.
  - DOE approves the initial DSA, and DSA changes using the USQ process.
- Board identified cases where 10 CFR 830 does not require DOE approval for significant changes (e.g., JCO, ESS).
- The piecemeal approach may not be appropriate because they may miss latent issues or cumulative impacts.

Specific Sub-recommendations

- ***Sub-Recommendation 3a*** *– Causal analysis to identify the underlying issues in the safety basis approval process, and use the findings to improve DOE's process.*
  - DOE cited "considerable implementation challenges," but provided no technical or safety rationale for why the annual approval was problematic to implement.
  - It is unclear why the annual safety basis updates were difficult for contractors to prepare or for DOE to approve.
  - Simply eliminating the DOE approval is not appropriate, and DOE should identify and address underlying issues.

Specific Sub-recommendations

- ***Sub-Recommendation 3b*** *– Revise rule to state that DOE's review of safety basis updates should consider cumulative effect of changes.*
  - If DOE only considers incremental changes one by one, it may miss cumulative impacts or latent defects.

- ***Sub-Recommendation 3c*** *– Require formal DOE approval of JCOs and ESSs.*
  - This would ensure that all safety basis changes are approved by DOE.
  - JCOs should be incorporated into annual updates reviewed and approved by the approval authority.

Current Staff Assessment

- ***Sub-Recommendation 3a*** – DOE rejected causal analysis for issues in approval process.
  - The Final Rule removes the requirement for DOE approval of annual updates.
  - The staff believes the concern remains.

- ***Sub-Recommendation 3b, 3c*** – DOE rejected these sub-recommendations related to cumulative changes and approval of JCO, ESS.
  - DOE stated these were "outside of the scope of the current rulemaking."
  - The staff believes the concern remains.

Summary

- The specific sub-recommendations for this area are focused on DOE approval of its contractor's changes to the safety analysis.

- DOE rejected all of the sub-recommendations.

- **The Board's concerns remain. DOE must review and approve the DSA on some periodicity to evaluate for cumulative impacts or latent defects. An exploration of reasons the annual approval periodicity proved problematic is warranted to determine if other improvements to DOE's processes are necessary.**

RECOMMENDATION 2020-1 PUBLIC MEETING: Safety Basis Process and Requirements

Robert Oberreuter, *Technical Staff*

December 4, 2020

Background

- 10 CFR 830 captures the fundamental requirements for nuclear safety management.
- DOE has not provided implementation requirements, or incorporated key concepts and lessons learned, in its regulatory framework.
- The Board concluded DSA development, review, and approval processes are ineffective and need improvement.

Specific Sub-recommendations

- ***Sub-Recommendation 4a*** *– 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.*

- ***Sub-Recommendation 4b*** *– 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.*

- If there is some difficulty with obtaining DOE approval, simply eliminating the DOE approval may not be appropriate. DOE needs to identify and address underlying issues.

Specific Sub-recommendations (cont.)

- ***Sub-Recommendation 4c*** *– Specify what safety basis documentation a contractor must submit when seeking approval for an action involving a USQ (proposed 10 CFR 830.203(d)).*

- ***Sub-Recommendation 4d*** *– 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.*

- ***Sub-Recommendation 4e*** *– 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.*

- Implementation requirements and fundamental nuclear safety concepts would help DOE ensure consistency across the complex.

Current Staff Assessment

- ***Sub-Recommendations 4a and 4b*** – DOE rejected causal analysis and removed the annual DSA approval requirement.
  - DOE rejected because "considering this matter in the current rulemaking."
  - The concern with DOE contractors' ability to submit quality DSAs remains.

- ***Sub-Recommendations 4c and 4d*** – DOE stated that it partially accepted sub-recommendations on requirements for USQs and TSRs, pending analysis to determine if improvements are necessary.
  - The technical basis for the need to establish requirements remains.
  - Board sent a letter on implementation of the PISA process.
  - Board sent a technical report on TSR violations.

Current Staff Assessment (cont.)

- ***Sub-Recommendation 4e*** – DOE rejected addition of SACs and defense-in-depth to 10 CFR 830, with analysis to determine if improvements necessary.
  - DOE rejected because "topic is outside of the scope of the current rulemaking."
  - The technical basis for the need to include fundamental concepts and lessons learned remains.

Recent Board Communications

- July 10, 2020, staff report, *Complex-Wide Implementation of the Potential Inadequacy of the Safety Analysis Process*
  - Contractors inconsistently implement the PISA process—the sole element of 10 CFR 830 that ensures a DOE site contractor take action when it becomes aware that its DSA may not be adequate.
  - Specific requirements and clearer guidance would improve the implementation of the PISA process and help reduce unknown risk.
- August 7, 2020, technical report, *Violations of the Nuclear Safety Basis*
  - There are differing interpretations across the complex on what constitutes a TSR violation, or more generally, a violation of the safety basis.
  - Lack of requirements limits DOE's ability to challenge the content and structure of proposed TSRs.
  - Clear requirements would enable DOE personnel to more easily hold contractors to an appropriate standard for TSR development.

Summary

- Sub-recommendation area focused on improvements to DOE's regulatory framework for nuclear facility safety basis development.
- DOE rejected or partially accepted without addressing the technical aspects of the Board's concerns.
- **The Board's concerns remain. DOE's nuclear safety regulatory framework needs clear requirements to ensure consistent, adequate implementation across the complex. An analysis of issues regarding contractor DSA submittals is warranted.**

RECOMMENDATION 2020-1 PUBLIC MEETING: Summary

Chris Roscetti, *Technical Director*

December 4, 2020

Summary of Sub-recommendations

Aging Infrastructure:

- DOE partially accepted but did not commit to specific action.
- The Board's concern remains.
- DOE lacks a formal, complex-wide regulatory structure for identifying, prioritizing, and performing upgrades necessary for the adequate protection of public and workers.

Hazard Categories:

- DOE rejected but made changes in the final rule partially addressing the Board's concerns.
- Hazard categorization implementation concerns exist due to deficiencies, inconsistencies, and non-conservatisms in the multiple standards used by DOE.

Summary of Sub-recommendations (cont.)

DOE Approvals:

- DOE rejected these sub-recommendations.
- The Board's concerns remain.
- DOE must review and approve the DSA on some periodicity to evaluate for cumulative impacts or latent defects.
- An exploration of reasons the annual approval periodicity proved problematic is warranted to determine if other improvements to DOE's processes are necessary.

Summary of Sub-recommendations (cont.)

Safety Basis Process and Requirements:

- DOE rejected or partially accepted these sub-recommendations.
- The Board's concerns remain.
- DOE's nuclear safety regulatory framework needs clear requirements to ensure consistent, adequate implementation across the complex.
- An analysis of issues regarding contractor DSA submittals is warranted.

Recommendation 2020-1

- DOE defense nuclear facilities have grown older and more complex since the rule was issued, but DOE is relaxing rather than reinforcing its regulatory framework.
- The Board's staff concludes the revised rule is part of a broader erosion in DOE's nuclear safety framework.
- **Recommendation 2020-1 is intended to strengthen DOE's regulatory framework, and maintain and improve federal accountability mechanisms and fundamental nuclear safety processes that were potentially undermined by DOE's revision to 10 CFR 830.**


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Hazard Categorization Backup Slides

Threshold Quantity Background

- DOE compares a facility's radiological and fissile material inventories to a table of threshold quantity (TQ) values in DOE Standard 1027 to determine a facility's hazard categorization.

Radionuclide	Hazard Category 2		Hazard Category 3		
	Curies	Grams	Curies	Grams	Limiting Pathway
U-233*	8.45E+02	8.73E+04	1.28E+01	1.33E+03	Inhalation
U-235*	9.54E+02	4.41E+08	1.45E+01	6.71E+06	Inhalation
Pu-238	7.37E+01	4.31E+00	2.60E+00	1.52E-01	Inhalation
Pu-239*	6.76E+01	1.09E+03	2.38E+00	3.82E+01	Inhalation

Table 2: Example TQ Table from DOE Standard 1027-18

*TQ value if criticality can be excluded.

Hazard Categorization Deficiencies

- NNSA SD 1027 uses a hazard category 2 TQ derivation methodology that is not technically justified and inconsistent with DOE Standards 1027-92 and 1027-18.
  - DOE Standards 1027-92 and 1027-18 make bounding assumptions regarding lung absorption type; NNSA SD 1027 does not.
  - For certain radionuclides, a hazard category 3 facility categorized using NNSA SD 1027 is allowed to have ~2-3 times more nuclear material than if categorized by DOE Standard 1027-18.

Hazard Categorization Deficiencies (cont.)

- DOE changed the quantitative methodology used to derive hazard category 3 TQs in Standard 1027-18 and NNSA SD 1027 compared to what was used in DOE Standard 1027-92.
  - For hazard category 3 TQs, Standard 1027-92 considered a threshold of 10 rem total effective dose and a threshold of 100 rem to a specific organ, and applied the more limiting value for each radionuclide.
  - Standard 1027-2018 and the NNSA SD only used the 10 rem total effective dose threshold and neglected the organ specific dose.
  - Change in methodology affects ~50 radionuclides.