Dominion Energy Nuclear Connecticut, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

December 28, 2022

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No. 22-349
NRA/SS: R0
Docket No. 50-423
License No. NPF-49

DOMINION ENERGY NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
PROPOSED LICENSE AMENDMENT REQUEST TO SUPPLEMENT SPENT FUEL POOL CRITICALITY SAFETY ANALYSIS

Pursuant to 10 CFR 50.90, Dominion Energy Nuclear Connecticut, Inc. (DENC) is submitting a license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3). The purpose of this LAR is to supplement the burnup credit portion of the current Criticality Safety Analysis (CSA), which was approved by the Nuclear Regulatory Commission (NRC) by letter dated May 28, 2019 (ADAMS Accession No. ML19126A000), to demonstrate that it bounds the use of gadolinia as a burnable poison (BP). This conclusion is demonstrated by citing industry guidance documents and submittals by other licensees, and by discussing how this prior work is applicable to MPS3.

DENC is planning to implement a new fuel assembly design for MPS3, which contains gadolinia as a neutron BP. Based on statements made by the NRC in the Safety Evaluation for North Anna Power Station's CSA and because gadolinia is not mentioned in the current MPS3 CSA, DENC determined that the MPS3 CSA should be supplemented to assess the potential impact of gadolinia in the burnup credit analysis. Evaluating this CSA Supplement per 10 CFR 50.59 determined that the activity results in a departure from a method of evaluation used in the safety analysis described in the Final Safety Analysis Report, and would therefore require prior NRC approval. This LAR does not propose any changes to the MPS3 Technical Specifications, take any credit for gadolinia in fresh fuel, or make any technical changes to the current CSA other than extending the bounds of applicability of the burnup credit. Since no credit is being taken for gadolinia in fresh fuel, this change is limited to the Spent Fuel Pool and does not affect the New Fuel Storage Racks.

Attachment 1 provides the Supplement to the Spent Fuel Pool Criticality Safety Analysis for MPS3. Attachment 2 provides the Regulatory Evaluation and Environmental Considerations for the proposed change.

The proposed change does not involve a Significant Hazards Consideration under the standards set forth in 10 CFR 50.92. The basis for this determination is included in Attachment 2. DENC has also determined that operation with the proposed change will not result in any significant increase in the amount of effluents that may be released offsite, or any significant increase in individual or cumulative occupational radiation

exposure. Therefore, the proposed amendment is eligible for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is needed in connection with approval of the proposed change.

The proposed amendment has been reviewed and approved by the station's Facility Safety Review Committee.

DENC requests approval of this LAR by December 31, 2023, with a 60-day implementation period.

In accordance with 10 CFR 50.91(b), a copy of this LAR is being provided to the State of Connecticut.

If you have any questions or require additional information, please contact Mr. Shayan Sinha at (804) 273-4687.

Sincerely,

James E. Holloway
Vice President – Nuclear Engineering and Fleet Support

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by James E. Holloway who is Vice President – Nuclear Engineering and Fleet Support of Dominion Energy Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 28th day of December, 2022.

My Commission Expires: 12/31/24.

CRAIG D SLY
Notary Public
Commonwealth of Virginia
Reg. # 7518653
My Commission Expires December 31, 2024

Notary Public

Commitments made in this letter: None

Attachments:

1. Supplement to Spent Fuel Pool Criticality Safety Analysis
2. Regulatory Evaluation and Environmental Considerations

cc: U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road, Suite 105
King of Prussia, PA 19406-1415

Richard V. Guzman
Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North, Mail Stop 08 C2
11555 Rockville Pike
Rockville, MD 20852-2738

NRC Senior Resident Inspector
Millstone Power Station

Director, Radiation Division
Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Attachment 1

SUPPLEMENT TO SPENT FUEL POOL CRITICALIY SAFETY ANALYSIS

Dominion Energy Nuclear Connecticut, Inc.
Millstone Power Station Unit 3

1. Purpose

Pursuant to 10 CFR 50.90, Dominion Energy Nuclear Connecticut, Inc. (DENC) is submitting a license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3). The purpose of this LAR is to supplement the burnup credit portion of the current (2019) Criticality Safety Analysis (CSA) by demonstrating that it bounds the use of gadolinia burnable poison (BP). This is demonstrated by citing prior work and discussing how this prior work is applicable to MPS3. This prior work is from industry guidance documents and submittals from other Licensees which conclude that it is conservative to ignore gadolinia for burnup credit in CSAs. No changes are being made to the MPS3 Technical Specifications (TS), no credit is being taken for gadolinia in fresh fuel, and no technical changes are being made to the current CSA other than extending the bounds of applicability of the burnup credit. Since no credit is being taken for gadolinia in fresh fuel, this change is limited to the Spent Fuel Pool (SFP) and is not affecting the New Fuel Storage Racks.

2. Background

The current CSA was submitted for approval on May 3, 2018 (Reference 1); supplemented by Request for Additional Information (RAI) responses on November 29, 2018; March 27, 2019; and May 7, 2019 (References 2, 3, and 4); and was approved by the Nuclear Regulatory Commission (NRC) in a letter dated May 28, 2019 (Reference 5, ML19126A000). The CSA followed the guidance of Nuclear Energy Institute (NEI) document 12-16, Revision 3 (Reference 6) which was the latest revision at the time but was not endorsed by the NRC.

DENC is planning to use a new fuel assembly design, GAIA, which contains gadolinia as a neutron poison. Similar to the current fuel used at MPS3, GAIA is configured in a standard 17x17 pressurized water reactor (PWR) fuel assembly design in which guide tubes and instrument tubes only take up one fuel lattice location. GAIA does not have Accident Tolerant Fuel characteristics. For example, the cladding is an un-coated zirconium alloy (M5 alloy fuel cladding and Q12 alloy grids), the fuel pellets consist of uranium dioxide, and are not doped.

The MPS3 CSA assumes bounding conservative depletion conditions for depleted fuel in its burnup credit analysis. This includes modeling the effects associated with the presence of BPs. The presence of the neutron absorber and the possible displacement of water from the guide tubes means that BPs harden the neutron energy spectrum which decreases the reactivity decrement that fuel experiences during burnup. Therefore, the burnup credit analysis portion of the CSA determined the depletion isotopic and reactivity effects of the following BP: Integral Fuel Burnable Absorber (IFBA), Pyrex BP, and Wet Annular Burnable Absorber (WABA). Pyrex BP was not bounded by WABA, but was separately dispositioned since it was only used in Cycles 1 and 2. The sensitivity cases showed that depletion with an increased number of WABA rods increased fuel reactivity

in the SFP, and that using the maximum projected WABA loading bounded the use of maximum IFBA loading. Therefore, maximum WABA was used in the depletion calculations to create the burnup curves (Attachment 5, Section 8.7 of Reference 1) that are conservative for lesser BP loadings (fewer WABA rods, un-poisoned fuel, and IFBA). Additionally, the CSA considered combinations of WABA and IFBA that would remain bounded by the use of maximum WABA alone. Therefore, the CSA covered and set a limit on the combined use of WABA and IFBA (Attachment 5, Section 8.7 and Table 13.3 of Reference 1).

The MPS3 CSA did not discuss the use of gadolinia BP. The Safety Evaluation (SE) for the recent North Anna Power Station (NAPS) Units 1 and 2 CSA declared that only citing previous work was not sufficient for including gadolinia within the scope of the CSA because the CSA did not provide justification as to why the previous work is applicable to NAPS (Section 3.4.3.3.5 of Reference 7). Considering the statement in the NAPS SE and that gadolinia is not mentioned in the current MPS3 CSA, DENC determined that the CSA should be supplemented to assess the potential impact of gadolinia in the burnup credit analysis. Evaluating this CSA supplement per 10 CFR 50.59 determined that the activity results in a departure from a method of evaluation used in the safety analysis described in the Final Safety Analysis Report, and therefore requires prior NRC approval.

3. Gadolinia Effect on Depletion Credit

3.1 Gadolinia Description

Gadolinia (Gd_2O_3) is an integral burnable absorber used in PWR fuel assemblies which is integrated into the fuel pellet matrix as UO_2-Gd_2O_3 (Section 2.2 of Reference 9). Since it is integrated into the fuel matrix, the presence of gadolinia displaces UO_2 from the fuel pin, effectively reducing the uranium fuel density.

Integrating gadolinia into the fuel matrix also decreases the thermal conductivity of the fuel pin (Section 3.3.2 of Reference 9). To compensate for this, gadolinia-bearing pins will often have a reduced U-235 enrichment compared to non-gadolinia fuel pins in the same assembly.

3.2 Industry Guidance

There have been several industry guidance reports which demonstrate that it is conservative to ignore gadolinia for burnup credit applications. This section discusses these studies and how they are applicable to MPS3.

Regulatory Guide RG 1.240

RG 1.240 (Reference 11) describes a CSA approach which the NRC considers acceptable for light-water reactors. It endorses NEI 12-16, Revision 4 (Reference 8) with clarifications and exceptions. The clarifications and exceptions are listed in the RG, but none specifically involve the modeling of BPs for burnup credit or any part of Section 4.2.1 ("Depletion Analysis") of NEI 12-16. However, the clarification in Regulatory Position C.1.p of RG 1.240 states that "Licensees or applicants should ensure that a conclusion [of NEI 12-16] is applicable to their circumstances before implementing the guidance associated with that conclusion." This CSA supplement fulfills this requirement. It demonstrates that the referenced prior work (References 9 and 10) are applicable to MPS3 and that the NEI 12-16 conclusion concerning the treatment of gadolinia integral BP is applicable to MPS3.

NEI 12-16

Industry guidance document NEI 12-16, Revision 4 (Reference 8) provides guidance for CSAs at light water moderated nuclear power plants. It discusses the effect that the gadolinium has on the fuel reactivity of depleted fuel and concludes that modeling the fuel with no gadolinia is a conservative approach. Section 4.2.1 of Reference 8 states:

> *Studies have shown that Gadolinium and Erbium burnable absorbers can be conservatively neglected [18]. While spectral hardening does occur in fuel bearing Gadolinium or Erbium, the positive reactivity impact of this effect is never larger than the negative reactivity impact due to displacement of fissile material (UO_2) and residual Gadolinium/Erbium. Therefore, it is conservative to model fuel bearing Gadolinium or Erbium as though the integral absorber was not present. Note that when Gadolinium and/or Erbium are excluded from the analysis, the models cannot credit the reduced UO_2 and fuel density caused by Gadolinium and Erbium; a fuel density based on fuel without integral absorber must be used. Recent analysis has confirmed that neglecting Gadolinium and Erbium burnable absorbers is a conservative approach [31].*

NEI 12-16 is applicable for light-water nuclear PWR and boiling water reactor (BWR) spent fuel pool storage racks (Section 1.1 of Reference 8). MPS3 falls within this applicability range since it is a Westinghouse four-loop, light-water PWR. Additionally, the MPS3 CSA uses a bounding high fuel density that does not take credit for the UO_2 displacement due to gadolinia (Attachment 5, Section 7.2.2 of Reference 1).

NUREG/CR-6760

NEI 12-16 references NUREG/CR-6760 (Reference 9) to support its conclusions. This NUREG researched the effect that BPs have on burnup credit, including gadolinia. Section 3.3.2 of Reference 9 states:

> *Various gadolinia loadings (wt % Gd_2O_3 and number of gadolinia-bearing rods) and enrichment combinations were studied in order to establish the reactivity effect as a function of burnup. The absorber loading and enrichment combinations considered are based on actual fuel assemblies and were selected to encompass the range of known variations.*
>
> *Analyses are presented in the following subsections for two distinct fuel assembly designs that employ gadolinia-bearing rods: the CE 16 x 16 assembly design (which includes large water holes) and the Siemens 17 x 17 design. The Siemens assembly design does not include oversized water holes, and thus is expected to be representative of other similar fuel assembly designs (e.g., Framatome ANP and Westinghouse designs that employ gadolinia-bearing rods).*

The NUREG found that the presence of gadolinia reduces fuel assembly reactivity throughout its lifetime and recommended that "for those IBAs [Integral Burnable Absorbers] other than IFBAs, burnup credit criticality safety analyses may simply and conservatively neglect the presence of the IBAs by assuming nonpoisoned equivalent enrichment fuel" (Section 5 of Reference 9).

NUREG/CR-6760 is broadly applicable. The majority of criticality calculations were performed using representative depletion parameters and representative out-of-reactor parameters. As stated in the NUREG, "The majority of the calculations were done with an infinite array of assemblies to gain an understanding of behaviors and trends and so that the results would be general (i.e., not dependent on storage cell specifications, such as poison loading)." (Section 3.3 of Reference 9).

The gadolinia calculations used a Siemens 17x17 fuel assembly design. The Siemens 17x17 fuel assembly matches the general geometry of the MPS3 fuel (e.g., very similar pin pitch, fuel cladding dimensions, fuel pellet dimensions, guide tubes only take up one fuel lattice location, etc.). Additionally, various gadolinia loadings and enrichments from 2.0 – 8.0 wt% were used (Section 3.3.2.2 of Reference 9). NUREG/CR-6760 concluded that the presence of gadolinia reduces fuel assembly reactivity for the whole range of gadolinia enrichments it considered.

NUREG/CR-6760 also ran confirmatory cases with assemblies in poisoned racks (Section 3.3.5.4 of Reference 9). These cases are applicable to MPS3 because

the Region 1 and 2 SFP fuel racks are similar to the racks in the study since they are water moderated and use BORAL neutron poisoned racks.

Electric Power Research Institute (EPRI) Technical Report 3002008197

NEI 12-16 also references EPRI Technical Report 3002008197 (Reference 10) to support its conclusions. As discussed earlier, gadolinia-bearing fuel pins often have a reduced U-235 enrichment compared to non-gadolinia fuel pins in the same assembly. One difference between NUREG/CR-6760 and the MPS3 CSA is the modeling of fuel pin enrichment variation across the assembly lattice. In the NUREG, the baseline no-gadolinia assemblies were modeled using the same fuel pin enrichment variation across the assembly as the corresponding gadolinia assembly (Section 3.3.2.2 of Reference 9). The MPS3 CSA uses a single enrichment across its fuel lattice and Technical Specification 3.9.13 specifies the use of the "maximum initial planar volume average" enrichment (Reference 1). EPRI 3002008197 investigated this difference by comparing "the reactivity of the gadolinium-bearing fuel assembly to the reactivity of the average enriched fuel assembly in order to ensure that possible non-conservative weighting of the enrichment does not overwhelm the residual gadolinium penalty" (Section 12 of Reference 10). This study confirmed that the reactivity of fuel assemblies containing gadolinia is still lower than no-gadolinia fuel assemblies for the whole burnup range considered in the EPRI report (0 – 60 GWD/MTU). Therefore, EPRI 3002008197 concluded that "ignoring gadolinium burnable absorbers in a criticality safety analysis is conservative" (Section 13 of Reference 10).

The work in EPRI 3002008197 is applicable to MPS3 because of the similarities of the study and the design of MPS3: the study used a Siemen's 17x17 fuel assembly design which is the same general design that MPS3 uses, the study uses gadolinia enrichments from 2.0 – 8.0 wt% which are the enrichments that are expected to be used at MPS3, and both the study and MPS3 use an averaged U-235 enrichment.

3.3 Submittals from Other Licensees

Along with the industry studies, there have been several docketed CSAs from licensees which also demonstrate that it is conservative to ignore gadolinia. This section discusses these CSAs and how they are applicable to MPS3.

Prairie Island Nuclear Generating Plant (PINGP)

The NUREG/CR-6760 confirmatory cases used poisoned racks (Section 3.3.5.4 of Reference 9). However, the PINGP racks (Section 3.2.3.1 of Reference 12) and the MPS3 Region 3 racks (Attachment 5, Section 4.2 of Reference 1) are both assumed to be un-poisoned racks (uncredited Boraflex racks). PINGP responded to an NRC Request for Additional Information with an analysis showing that

modeling no gadolinia is conservative for their un-poisoned racks (Section 3.2.2.4.2 of Reference 12). The PINGP analysis is relevant to MPS3 because both have un-poisoned rack regions.

Millstone Power Station Unit 2 (MPS2)

MPS2 submitted an LAR in 2012 (Reference 13). In this submittal, it determined that not modeling gadolinia in the fuel is conservative:

[…] assemblies contained various amounts of gadolinia burnable absorber mixed with UO_2 in some fuel rods. Depleted fuel reactivity effects of these absorbers were analyzed. In all cases examined, ignoring the presence of burnable absorbers is conservative for new and depleted fuel SFP K_{eff} calculations.

The NRC staff found the approach of neglecting the gadolinia and modeling all the fuel as UO_2-only was acceptable (Section 3.4.3.3.5 of Reference 14).

The MPS2 CSA shares many characteristics with the MPS3 CSA as discussed below. These similarities show that the conclusions for MPS2 are applicable to MPS3 and support the assertion that the use of gadolinia is bounded by the MPS3 burnup credit analysis.

- Both analyses credit burnup for fuel enriched up to a maximum of 5.0 wt%
- Both analyses credit soluble boron in the SFP, meaning that burnup is credited for both borated and unborated conditions.
- Both analyses used SCALE modules TRITON (fuel depletion), KENO V.a (criticality), and the ENDF/B-VII 238 neutron energy group library.
- MPS2 compared gadolinia cases to un-poisoned cases and found that un-poisoned depletion bounds depletion with gadolinia. The MPS3 depletion analysis assumed the use of maximum WABA which bounds un-poisoned depletion.

3.4 Applicability Summary for Millstone Power Station Unit 3

Below are some SFP rack, fuel assembly, and depletion parameters which are important to the MPS3 CSA (Attachment 5, Section 13 of Reference 1). The prior analyses discussed in this submittal bound MPS3 for these parameters. This shows that the conclusion determined in the guidance documents and submittals from other Licensees are applicable to the MPS3 CSA with respect to the effect gadolinia has on the depletion analysis.

- Region 1 and Region 2 of the MPS3 SFP are BORAL poisoned racks: BORAL poisoned models were used in portions of NUREG/CR-6760 (Reference 9)
- Region 3 of the MPS3 SFP are un-poisoned racks (uncredited Boraflex racks): PINGP (Reference 12) and MPS2 (Reference 14) credited burnup in un-poisoned racks and both specifically have uncredited Boraflex racks.
- Maximum MPS3 U-235 enrichment ≤5.0 wt%: MPS2 (Reference 14) credited burnup for enrichments up to 5.0 wt%.
- MPS3 uses 17x17 fuel assemblies: NUREG/CR-6760 (Reference 9) and EPRI 3002008197 (Reference 10) used 17x17 fuel assemblies in their studies.
- MPS3 standard depletion uses maximum WABA: NUREG/CR-6760 (Reference 9) and EPRI 3002008197 (Reference 10) shows un-poisoned assemblies bound gadolinia assemblies. Depletion with WABA bounds depletion with IFBA with secondary sources (Attachment 5, Section 8.7 of Reference 1) and depletion using un-poisoned assemblies.

4. Impact on the Criticality Safety Analysis

As stated in the Background section, GAIA is a standard 17x17 PWR fuel assembly design that does not have Accident Tolerant Fuel characteristics. The CSA used a composite fuel assembly design with the key characteristics listed in Table 13.2 of Attachment 5, Reference 1, intended to represent current and legacy fuel designs. The physical dimensions and characteristics of GAIA, other than the use of gadolinia BP, are within the bounds of the composite fuel design modeled in the CSA.

The CSA also listed key depletion parameters in Table 13.3 of Attachment 5, Reference 1. The maximum burnup averaged soluble boron, maximum core average moderator exit temperature, and maximum burnup averaged relative assembly power will continue to be verified by procedure. The parameter about loading multiple types of BP in the same assembly will not be applicable because DENC will not load another BP type with gadolinia in the same assembly. DENC will revise relevant procedures to preclude this configuration for GAIA fuel.

The intra-assembly axial burnup distributions assumed in the CSA are the bounding shapes from NUREG/CR-6801 (Attachment 5, Section 8.6 of Reference 1). The CSA justified the use of these shapes because MPS3 burnup data was used in NUREG/CR-6801 to originally derive the shapes, and because MPS3 ignores its axial enrichment blankets which is conservative with respect to the end effect. These justifications are still applicable when using gadolinia. Additionally, the NUREG/CR-6801 database included fuel designs that used gadolinia (Section 3.1 of Reference 15). Therefore, the axial burnup shapes assumed in the CSA remain bounding.

The intra-assembly radial (i.e., horizontal) burnup distribution assumed in the CSA is conservatively based on 16 cycles of MPS3 burnup history (Attachment 5, Section 9.6.6 of Reference 1). The primary cause for radial burnup tilts is the assembly's location in the reactor during its cycles of operation. This effect will not change since the fuel management scheme when using GAIA will largely remain the same as in previous cycles. A secondary cause for radial burnup tilts is the assembly's BP loading. The majority of the MPS3 burnup history is from IFBA assemblies which are always symmetrically loaded within an assembly. DENC will only use gadolinia symmetrically within an assembly to ensure the radial tilt history used in the CSA remains applicable. DENC will revise relevant procedures to ensure symmetric gadolinia loading.

5. Summary and Conclusion

The industry guidance document NEI 12-16 (Reference 8) references NUREG/CR-6760 (Reference 9) and EPRI 3002008197 (Reference 10), and concludes that it is conservative to ignore gadolinia in the depletion analysis for CSAs. Additionally, there are several relevant NRC approved CSAs for other licensees that conclude it is conservative to ignore gadolinia in their depletion analysis. RG 1.240 (Reference 11) endorses NEI 12-16 with the exception that utilities must demonstrate that the NEI 12-16 conclusions are applicable to their specific plant. This CSA supplement submittal demonstrates that the findings of NEI 12-16 are applicable to MPS3. The CSA normal and accident scenarios were reviewed and determined to remain conservative. Therefore, the depletion analysis in the current MPS3 SFP criticality safety analysis of record bounds the effects associated with the future use of fuel containing gadolinia integral burnable absorber.

6. References

1. Letter from DENC to NRC, “Millstone Power Station Unit 3, License Amendment Request Regarding Proposed Technical Specifications Changes for Spent Fuel Storage and New Fuel Storage,” 05/03/2018 (NRC ADAMS Accession Number ML18128A049).
2. Letter from DENC to NRC, “Millstone Power Station Unit 3, Response to Request for Additional Information for Proposed Technical Specifications Changes for Spent Fuel Pool Storage and New Fuel Storage,” 11/29/2018 (NRC ADAMS Accession Number ML18340A028).
3. Letter from DENC to NRC, “Millstone Power Station Unit 3, Response to Request for Additional Information for Proposed Technical Specification Changes for Spent Fuel Pool Storage and New Fuel Storage,” 03/27/2019 (NRC ADAMS Accession Number ML19092A332).
4. Letter from DENC to NRC, “Millstone Power Station Unit 3, Revised Responses for Two Request for Additional Information Questions for Proposed Technical Specification Changes for Spent Fuel Pool Storage and New Fuel Storage,” 05/07/2019 (NRC ADAMS Accession Number ML19135A067).
5. Letter from NRC to DENC, “Millstone Power Station, Unit No. 3 - Issuance of Amendment No. 273 Regarding Technical Specification Changes for Spent Fuel Storage and New Fuel Storage (EPID L-2018-LLA-0126),” 05/28/2019 (NRC ADAMS Accession Number ML19126A000).
6. NEI 12-16, Revision 3, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants,” 03/31/2018 (NRC ADAMS Accession Number ML18088B400).
7. Letter from NRC to VEPCO, “North Anna Power Station, Unit Nos. 1 and 2 - Issuance of Amendments to Revise Technical Specifications Regarding New and Spent Fuel Storage (CAC NOS. MF9712 AND MF9713, EPID L-2017-LLA-0240),” 07/27/2018 (NRC ADAMS Accession Number ML18180A197).
8. NEI 12-16, Revision 4, “Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants,” 09/30/2019 (NRC ADAMS Accession Number ML19269E069).
9. NUREG/CR-6760, "Study of the Effect of Integral Burnable Absorbers for PWR Burnup Credit," 03/31/2002 (NRC ADAMS Accession Number ML020770436).
10. EPRI 3002008197 “Sensitivity Analyses for Spent Fuel Pool Criticality – Revision 1” (NRC ADAMS Accession Number ML18088B399).
11. RG 1.240, “Fresh and Spent Fuel Pool Criticality Analyses,” 03/31/2021 (NRC ADAMS Accession Number ML20356A127).

12. Letter from NRC to Northern States Power Company – Minnesota, “Prairie Island Nuclear Generating Plant, Units 1 and 2 - Issuance of Amendments re: Spent Fuel Pool Criticality Changes,” 08/29/2013 (NRC ADAMS Accession Number ML13241A383).

13. Letter from DENC to NRC “Millstone Power Station Unit 2 License Amendment Request Regarding Proposed Technical Specifications Changes for Spent Fuel Storage,” 12/17/2012 (NRC ADAMS Accession Number ML12362A391).

14. Letter from NRC to DENC, “Millstone Power Station, Unit 2 - Issuance of Amendment No. 327 Re: Proposed Technical Specification Changes for Spent Fuel Storage (CAC No. MF0435),” 06/23/2016 (NRC ADAMS Accession Number ML16003A008).

15. J. C. Wagner, M. D. DeHart, and C. V. Parks, “Recommendations for Addressing Axial Burnup in PWR Burnup Credit Analyses,” US Nuclear Regulatory Commission, NUREG/CR-6801 Oak Ridge National Laboratory, Oak Ridge, Tenn. (2003).

Attachment 2

REGULATORY EVALUATION AND ENVIRONMENTAL CONSIDERATIONS

Dominion Energy Nuclear Connecticut, Inc.
Millstone Power Station Unit 3

1. Regulatory Evaluation

1.1 Applicable Regulatory Requirements and Criteria

Appendix A to Title 10 of the Code of Federal Regulations, Part 50 (10 CFR 50), General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," states that "criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations." The Nuclear Regulatory Commission (NRC) has established a 5% subcriticality margin (i.e., k-effective (k_{eff}) less than or equal to 0.95) for nuclear power plant licensees to comply with GDC 62.

Subpart (b)(4) of 10 CFR 50.68, "Criticality accident requirements," specifies, "if credit is taken for soluble boron, the k-effective of the SFP storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water."

The other subparts of 10 CFR 50.68, including subparts (b)(2) and (b)(3), are not affected by this submittal due to the narrow scope of this submittal.

1.2 No Significant Hazards Consideration

Dominion Energy Nuclear Connecticut, Inc. (DENC) is submitting a license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3). The purpose of this LAR is to supplement the burnup credit portion of the current (2019) Criticality Safety Analysis (CSA) by demonstrating that it bounds the use of gadolinia burnable poison (BP). No changes are being made to the MPS3 Technical Specifications (TS), no credit is being taken for gadolinia in fresh fuel, and no technical changes are being made to the current CSA other than extending the bounds of applicability of the burnup credit. Since no credit is being taken for gadolinia in fresh fuel, this change is limited to the Spent Fuel Pool (SFP) and is not affecting the New Fuel Storage Racks.

DENC has performed the significant hazards consideration for the proposed change by addressing the three standards set forth in 10 CFR 50.92, “Issuance of Amendment,” as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: *No*.

The proposed change demonstrates that the burnup credit portion of the approved Criticality Safety Analysis (CSA) for Millstone Power Station Unit 3 (MPS3) bounds the use of gadolinia burnable poison (BP). This activity does not revise the MPS3 Technical Specifications (TS).

The proposed change validates that it is conservative to neglect gadolinia in the depletion analysis for CSAs, based on industry guidance that is also applicable to MPS3. Dominion Energy Nuclear Connecticut, Inc. (DENC) reviewed the CSA normal and accident scenarios and determined that they remain conservative. Thus, it is concluded that the consequences of previously evaluated accidents remain unchanged. The operational limitations proposed in support of this change are restrictive and would therefore not increase the probability of an accident.

The proposed change does not alter the processes for handling fuel assemblies. The MPS3 program for choosing fuel assembly storage locations, and for fuel handling and assuring that the fuel assemblies are placed into correct locations will remain in place. Thus, the probability of a fuel assembly misloading or a fuel assembly drop will not increase with the proposed change.

Therefore, it is concluded that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: *No.*

   The proposed change will introduce a new burnable absorber in the fuel assembly. However, the current CSA already considers multiple types of burnable absorbers in its accident analyses. Therefore, a new burnable absorber type will not create the possibility of a new or different kind of accident from any accident previously evaluated.

   The proposed change will not change fuel/Rod Control Cluster Assembly (RCCA) handling equipment nor how fuel assemblies and RCCAs are handled and stored, there is no mechanism for creating a new or different kind of accident not previously evaluated. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

   There is no change to any other plant equipment, including how equipment is operated and maintained. Thus, the proposed change does not create the

possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: *No*.

   The licensing requirement for the Spent Fuel Pool (SFP) is that k_{eff} remain < 0.95 under normal and all postulated accident conditions with credit for soluble boron. The criticality safety evaluation concluded that this requirement is met for the bounding postulated accident of a multiple misload of fuel assemblies into each Region 2 fuel storage location. The analyses apply to all fuel assemblies currently stored in the MPS3 SFP and to future anticipated fuel designs. The proposed change does not adversely affect the safety margins for the accident scenarios evaluated in the CSA.

   In addition, the criticality safety evaluation concludes that the SFP will maintain k_{eff} < 1.0 with 0 ppm soluble boron in the SFP under normal conditions with the maximum allowed reactivity fuel assembly stored in each fuel storage location. The proposed change does not adversely affect the safety margins for the normal condition scenarios evaluated in the CSA.

   Therefore, all the margins of safety are maintained, and the proposed change does not involve a significant reduction in a margin of safety

Based on the above information, DENC concludes that the proposed license amendment involves no significant hazards consideration under the criteria set forth in 10 CFR 50.92(c) and, accordingly, a finding of no significant hazards consideration is justified.

1.3 Conclusion

Based on the considerations discussed above, there is reasonable assurance that (1) the health and safety of the public will not be endangered by the proposed changes, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the requested license amendments will not be inimical to the common defense and security or to the health and safety of the public.

2. Environmental Considerations

DENC has reviewed the proposed license amendment for environmental considerations. The proposed license amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.