Millstone Power Station Unit 3 (MPS3) Supplement to the Spent Fuel Pool (SFP) Criticality Safety Analysis (CSA)

September 7, 2022

Dominion Energy

MPS3 – Supplement to the SFP CSA

Agenda

- Background
- Reason for Request
- Proposed Resolution
- Proposed Justification for Submittal
- Submittal Conclusion
- Schedule

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Background

- Three different SFP rack types at MPS3:
  - Region 1 – Boral poisoned, flux trap design
    - Region 1B: Two rows closest to SFP wall
    - Region 1A: Remaining rows of Region 1
  - Region 2 – Boral poisoned, non-flux trap design
  - Region 3 – Uncredited Boraflex, flux trap design

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Background (cont.)

- Current CSA was submitted in 2018 and approved in 2019
  - Analysis has a modern CSA methodology based on NEI 12-16, Revision 3 (current Revision at the time of approval)

- Current CSA takes credit for burnup
  - CSA demonstrated that the burnable poison (BP) WABA bounds IFBA during depletion
  - Technical Specification burnup curves assume assemblies contain maximum WABA during depletion

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Background (cont.)

- Current CSA did not have any discussion on the use of gadolinia as a burnable poison
  - The SE, accordingly, did not have any discussion on the use of gadolinia
- Citing NEI 12-16 alone is not sufficient for including gadolinia, the applicability of previous work must be demonstrated
  - This is stated in the RG 1.240, C.1.p clarification
  - This is also stated in the 2018 North Anna CSA SE

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Reason for Request

- New fuel assembly design will be used at MPS3
  - Gadolinia will be used as the burnable poison

- Depletion credit in the CSA assumes a different burnable poison type
  - CSA does not justify that gadolinia is bounded

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Proposed Resolution

- Submit a supplement to the current MPS3 CSA to the NRC
  - Justify through previous work that the use of gadolinia BP is bounded by the current CSA's burnup credit analysis
  - Demonstrate the previous work's applicability to MPS3

- Scope:
  - No Technical Specifications are being changed
  - No credit is being taken for gadolinia in fresh fuel
  - No calculations are being updated or added to the current CSA
  - Only change is to extend the burnup credit's bounds of applicability

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Proposed Justification for Submittal

- Discussion of the NRC endorsed guidance in RG 1.240
  - RG 1.240 endorses NEI 12-16, Rev. 4
  - NEI 12-16 states modeling no gadolinia is conservative during depletion
  - NEI 12-16 references NUREG/CR-6760 and EPRI 3002008197
  - These reports investigated the effects of gadolinia on burnup credit and determined its use to be conservative
  - DENC will demonstrate that these findings are applicable to MPS3 (Satisfying the RG 1.240, C.1.p clarification)

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Proposed Justification for Submittal (cont.)

- Discussion of previous utility submittals with gadolinia work
  - Prairie Island (2013) and Millstone Unit 2 (2016) submittals investigated the effects of gadolinia on burnup credit and determined its use to be conservative
  - DENC will demonstrate that these findings are applicable to MPS3
- The CSA normal and accident scenarios will remain conservative

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Proposed Justification for Submittal (cont.)

- No changes to current Technical Specifications
  - New Fuel Storage Area takes no BP credit
  - Region 1A - high enrichment, low burnup, gadolinia cannot be used
  - SFP burnup credit applicability extended to include gadolinia BP

Table 13.4: MPS3 SFP Storage Constraint Summary

Region	Geometry	Credits	Description
1A	4 out of 4	None	≤ 4.75 wt% U-235
1A	4 out of 4	≥ 12 IFBA	≤ 5.00 wt% U-235
1A	4 out of 4	Burnup	≥ 2 GWd/MTU, ≤ 5.00 wt% U-235
1B	4 out of 4	SFP wall	≤ 5.0 wt% U-235, two rows of rack cells nearest the West SFP wall (Figure 13.1).
2	4 out of 4	Burnup	Table 13.5
2	4 out of 4	Control rod	≤ 5.00 wt% U-235
3	4 out of 4	Burnup, decay time	Table 13.5

Unused with gadolinia fuel

Burnup requirements apply to gadolinia fuel

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Submittal Conclusion

- Industry guidance reports demonstrated that gadolinia can conservatively be unmodeled in the depletion analysis
  - Supplement will demonstrate applicability to MPS3
- Utility submittals demonstrated that gadolinia can conservatively be unmodeled in the depletion analysis
  - Supplement will demonstrate applicability to MPS3
- Therefore, the depletion analysis in the current MPS3 SFP CSA bounds the effects associated with the use of gadolinia BP

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Schedule

- Submittal date is targeted for 4Q2022
- NRC approval will be requested 12 months after submittal
  - Supports implementation by 3R23 (spring 2025) outage
- If this supplement is approved, DENC would consider these items as the licensing basis for MPS3 SFP criticality:
  - Approved SFP CSA in 2019, including RAIs and SE
  - Approved 2022 CSA Supplement

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Questions?

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References

MPS3 Licensing Basis

- Letter to NRC, “Millstone, 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).
- 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).

Industry Guidance

- 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).
- 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).
- NUREG/CR-6760, "Study of the Effect of Integral Burnable Absorbers for PWR Burnup Credit" 03/31/2002 (NRC ADAMS Accession Number ML020770436).
- EPRI 3002008197 “Sensitivity Analyses for Spent Fuel Pool Criticality – Revision 1” (NRC ADAMS Accession Number ML18088B399).
- Regulatory Guide RG 1.240, “Fresh and Spent Fuel Pool Criticality Analyses”, 03/31/2021 (NRC ADAMS Accession Number ML20356A127).

Utility SEs

- 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).
- Letter from NRC to Prairie Island, “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).
- 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).

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Acronyms

- BP – Burnable Poison
- CFR – Code of Federal Regulations
- CSA – Criticality Safety Analysis
- DENC – Dominion Energy Nuclear Connecticut
- EPRI – Electric Power Research Institute
- IFBA – Integral Fuel Burnable Absorber
- MPS3 – Millstone Power Station Unit 3
- NEI – Nuclear Energy Institute
- NRC – Nuclear Regulatory Commission
- RAI – Request for Addition Information
- RG – Regulatory Guide
- SE – Safety Evaluation
- SFP – Spent Fuel Pool
- WABA – Wet Annular Burnable Absorber