Millstone Power Station Unit 3 (MPS3) Alternative Request for Reactor Pressure Vessel Head Penetration Nozzle (RPVHPN) Peening Follow-up Examination

August 29, 2022

Dominion Energy®

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Alternative for RPVHPN Peening Follow-Up Exam

AGENDA

- Background
- Proposed Alternative
- Technical Justification
- Conclusions
- Schedule

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Background – Regulatory Requirements

- 10 CFR 50.55a(g)(6)(ii)(D)(5) states, in part, that a reactor pressure vessel (RPV) upper head with nozzles and associated J-groove welds mitigated by peening can obtain examination relief from the requirements of Code Case N-729-6, Table 1 if the peening meets the performance criteria, qualification and examination requirements of MRP-335, Revision 3-A.
- For RPVHPNs with effective degradation years (EDY) < 8 years, Section 4.3.3 of MRP-335, Revision 3-A, provides the "Follow-Up Examination" requirement below:
  - If all RPVHPNs are free from pre-peening flaws, inspection is performed on each RPVHPN in the second refueling outage (RFO) after peening.

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Background – Plant-Specific

- Dominion Energy Nuclear Connecticut, Inc. (DENC) implemented an Ultra High Pressure Cavitation Peening (UHPCP) process at MPS3 during the fall 2020 RFO.
- Per MRP-335, Revision 3-A, the follow-up examination is required during the fall 2023 RFO.
  - The examination would be performed on the control rod drive mechanism (CRDM) nozzles and vent pipe assembly, which use Alloy 82/182 welds to join to Alloy 600 members.
- The MPS3 RPV upper head operates at Reactor Cold-leg Temperature (T_{cold}) and has experienced less than 8 EDY.
- Previous examinations for the MPS3 RPV upper head have identified no indications attributed to primary water stress corrosion cracking (PWSCC).

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Proposed Alternative

- Pursuant to 10 CFR 50.55a(z)(1), DENC is planning to request a one-time alternative to the requirements of 10 CFR 50.55a(g)(6)(ii)(D), which would permit the volumetric examination for the subject nozzles to be deferred from fall 2023 to spring 2025.
- The proposed alternative would not change visual examination frequency.
  - Bare metal visual examinations will be performed each RFO in accordance with MRP-335, Revision 3-A.
- Deferring this examination to the spring 2025 RFO would:
  - Alleviate scheduling and resource conflicts with the RPV hot leg dissimilar metal weld post-peening follow-up examination, and
  - Align with the RPVHPN post-peening follow-up examination frequency required by the vendor warranty.

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Technical Justification – PWSCC Considerations

- A pre-peening volumetric examination was conducted in accordance with MRP-335 Revision 3-A and did not identify any indications of cracking attributed to PWSCC.
- The peening application for MPS3 followed MRP-335 Revision 3-A without any deviations.
- The MPS3 peening met the MRP-335, Revision 3-A depth of compression requirements.
  - Per MRP-335, Revision 3-A, in cases when a shallow pre-existing flaw is located within a region of compressive residual plus operating stress, PWSCC growth of the pre-existing flaw would likely be arrested.
- A calculation of RIY [reinspection years] for an unmitigated head (per Code Case N-729-6) concluded that the next volumetric examination would not be required until the fall of 2026.
  - The reinspection frequency for unmitigated heads is conservative to apply for peened heads, as peening reduces the likelihood of PWSCC occurrence.

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Technical Justification – Defense In Depth

- Continued bare metal visual examination would provide defense in depth in the unlikely event of pressure boundary leakage due to:
  - Base metal or J-groove weld cracking, or
  - Small flaws that are too shallow to be reliably detected in the pre-peening examination.
- The MPS3 boric acid corrosion program provides both detection and analysis of leakage of borated water inside containment.
- MPS3 Technical Specification (TS) 3.4.6.2 requires online leakage detection and outlines the timely actions required to maintain safe operability for Reactor Coolant System leakage greater than 1 gallon per minute (gpm).
- DENC also implements a 0.1 gpm action level on unidentified leakage for MPS3, consistent with WCAP-16465-NP.

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Conclusions

- The lack of PWSCC for the MPS3 RPV upper head supports performing inspection during the third RFO after peening.
- Since MPS3 peening met the MRP-335, Revision 3-A requirements, PWSCC growth of shallow, pre-existing flaws would likely be arrested.
- A calculation of RIY for an unmitigated head, which is conservative for a peened head, supports deferral of follow-up examination.
- Defense in depth is maintained through continued performance of the bare metal visual examination each RFO, boric acid corrosion control practices, and the plant's online leak detection capabilities.
- Therefore, deferring the follow-up examination from the fall 2023 RFO to the spring 2025 RFO would maintain an acceptable level of quality and safety.

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Schedule

- Facility Safety Review Committee (FSRC) is targeted for mid September 2022.
- Alternative Request submittal is targeted for the end of September 2022.
- NRC approval will be requested one year after submittal, to support implementation by the fall 2023 outage.

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Questions?

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