UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 3, 2024

Eric S. Carr
President - Nuclear Operations and
Chief Nuclear Officer
Dominion Energy Nuclear Connecticut, Inc.
Millstone Power Station
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 3 - SUMMARY OF REGULATORY AUDIT SUPPORTING THE REVIEW OF LICENSE AMENDMENT REQUEST FOR IMPLEMENTATION OF FRAMATOME GAIA FUEL (EPID L-2023-LLA-0150)

Dear Eric Carr:

By letter dated October 30, 2023 (Agencywide Documents Access and Management System Accession No. ML23304A047), Dominion Energy Nuclear Connecticut, Inc. (the licensee) submitted a license amendment request (LAR) for Millstone Power Station, Unit No. 3 (MPS3). The LAR proposes to revise the MPS3 Technical Specifications (TSs) to support the implementation of Framatome GAIA fuel which is currently scheduled for onload during the spring 2025 refueling outage. The proposed TS changes include updating the reactor core safety limits (TS 2.1.1.2), reducing the Reactor Trip System Instrumentation Trip Setpoint for the P-8 Interlock (TS Table 2.2-1, Item 18.c), and adding to the list of approved methodologies for the Core Operating Limits Report (TS 6.9.1.6.b). Additionally, the licensee requests approval of the following items to support the use of GAIA fuel at MPS3: (1) the design basis limits for a fission product barrier associated with MPS3-specific application of certain methodologies (DOM-NAF-2-P-A, Appendix F, VEP-NE-2-A, and ANP-10338-P-A) and (2) mixed-core penalties for application to departure from nucleate boiling ratio analysis results of MPS3 cores containing both Framatome GAIA fuel and the resident Westinghouse fuel.

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a virtual audit to support its review of the LAR. The NRC staff reviewed information and interviewed licensee staff. The NRC staff issued its audit plan on April 4, 2024 (ML24088A330). Enclosure 1 of this audit summary lists the individuals that took part in or attended the audit. Enclosure 2 lists the NRC staff's audit questions.

The NRC staff conducted the audit using virtual meetings and an Internet-based portal provided by the licensee. Using the licensee's portal, the NRC staff reviewed information related to the LAR but not available on the MPS3 dockets. During the audit, the staff also met virtually with the licensee on May 1, 2024, May 8, 2024, May 21, 2024, and June 5, 2024. The staff used these meetings to confirm its understanding of the LAR, discuss the information in the portal, and decide whether the NRC staff identified any information that needs to be submitted on the docket to complete the staff's safety evaluation.

During the audit, the NRC staff and the licensee discussed the audit items in enclosure 2, and the staff identified information it needed on the docket to support its review. After the audit discussions, the NRC sent the licensee a request for additional information on July 31, 2024 (ML24213A260). The licensee intends to respond to the RAI by September 16, 2024.

The NRC's licensing project manager informed licensee staff by telephone on July 2, 2024, that the NRC staff had completed its audit. There were no open items resulting from the audit.

If you have any questions, please contact me at (301) 415-1030 or by email to Richard.Guzman@nrc.gov.

Sincerely,

/RA/

Richard V. Guzman, Senior Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-423

Enclosures:
1. List of Audit Participants
2. List of Audited Documents

cc: Listserv

List of Audit Participants

U.S Nuclear Regulatory Commission (NRC) Audit Team

NRC Staff
Richard Guzman - Senior Project Manager, NRR[1]/DORL[2]/LPL1[3]
Summer Sun - Senior Nuclear Engineer, NRR/DSS[4]/SNSB[5]
Noushin Amini - Senior Nuclear Engineer, NRR/DSS/SNFB[6]
Joshua Kaizer - Senior Nuclear Engineer, NRR/DSS/SNFB
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Dominion Energy Nuclear Connecticut, Inc. – Millstone Power Station, Unit 3 Team
Shayan Sinha, Consulting Engineer, Nuclear Regulatory Affairs
Timothy Olsowy – Millstone Station Licensing
Scott Luchau, Manager, Nuclear Safety Engineering
Thu Ho, Supervisor, Nuclear Safety Analysis
Brian Mount, Consulting Engineer, Nuclear Safety Analysis
Emily Tomlinson, Engineer III, Nuclear Safety Analysis
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Framatome personnel include:
Bob Clarke
Kevin Segard
Mustafa Siddiqi
Roberto Rubilar
Michelle Guzzardo
Rick Williamson

[1] Office of Nuclear Reactor Regulation
[2] Division of Operating Reactor Licensing
[3] Plant Licensing Branch 1
[4] Division of Safety Systems
[5] Nuclear Systems Performance Branch
[6] Nuclear Methods and Fuel Analysis Branch
[7] Technical Specifications Branch

List of Audit Requests

During its review of the license amendment request (LAR) for the Millstone Power Station, Unit No. 3 (MPS3), the U.S. Nuclear Regulatory Commission (NRC) staff provided the licensee with the following audit requests and audited the licensee's responses that the licensee posted on its internet-based portal.

Item	Audit Request
A.	<u>P-8 Trip Setpoint</u> Section 3.3 of Attachment 1 to the LAR dated October 30, 2023, discusses the determination of the P-8 trip setpoint. It indicates that a deterministic departure from nucleate boiling ratio (DNBR) analysis for a low flow condition consistent with the P-8 interlock logic (loss of a reactor coolant pump (RCP)) was performed to establish the proposed P-8 trip setpoint. The analysis shows that an upper limit of 45 percent power is required to ensure the P-8 setpoint maintains the calculated DNBRs within the acceptable limits for GAIA fuel. Please provide the following information: 1. Discuss the methods, computer codes, and values of key parameters (such as initial RCP flow, power level, reactor coolant system (RCS) pressure and temperature) used in the determination of the low flow condition consistent with the P-8 interlock logic (loss of an RCP). The discussion should show that the associated low flow condition determination used the NRC-approved methodology and computer codes, and the values of key parameters used for the flow determination would result in a lowest credible flow rate condition with consideration of uncertainties. 2. Discuss and justify that the values of key parameters (including initial reactor power, RCS pressure and temperature, RCS flow rate, axial and radial peaking factors, and power shape) used in the deterministic DNBR analysis would result in a lowest margin to the DNBR safety limits for MPS3 cores with GAIA fuel. 3. Identify the cases at different initial power levels that were analyzed to identify an upper limit of 45 percent power for use to determine the P-8 setpoint.
B.	<u>Methodologies and Acceptance Criteria for the Rod Ejection Analysis</u> Section 3.4 of Attachment 1 to the LAR dated October 30, 2023, discusses the methodologies and acceptance criteria for the MPS3 rod ejection analysis (REA). It indicates that the REA analysis for GAIA fuel, using the methodologies in topical report (TR) ANP-10338-P-A, was performed against the acceptance criteria in Regulatory Guide (RG) 1.236. Table 1 on page 8/25 in Attachment 1 to the LAR lists the proposed acceptance criteria for the REA analysis. Please provide the following information related to the acceptance criteria in Table 1.

	1. Row 2 of Table 1 lists the limit in Figure 1 of RG 1.236 as the acceptance criterion for the high-temperature cladding failure threshold. Section 3.1 of RG 1.236 restricts the applicability of the Figure 1 limit to events with prompt critical excursions (i.e., ejected rod worth greater than or equal to $1.00). Provide a discussion to address the compliance with the above restriction for use of the Figure 1 limit. 2. Row 3 of Table 1 lists 1.12 for COBRA-FLX/ORFEO-GAIA (Reference 8, FRM TR, ANP-10341-P-A, Revision 0) as the acceptance criterion for the DNBR design limit. Identify the page and section number in Reference 8 that includes the DNBR design limit of 1.12 and identify the page number in the associated NRC safety evaluation (SE) approving the DNBR design limit. 3. Row 4 of Table 1 lists the limits in Figures 2 and 4 of RG 1.236 as the acceptance criterion for the pellet-cladding mechanical interaction (PCMI) threshold. Section 3.2 of RG 1.236 restricts the applicability of Figures 2 and 4 to recrystallized annealed (RXA) cladding type. Address the compliance with the above restriction for use of Figures 2 and 4 limits. 4. Row 5 of Table 1 lists the limits, “less than 4754°F, decreasing linearly by 13.7°F per 10,000 MWD/MTU of burnup; rim melt is precluded,” as the acceptance criterion for the fuel centerline melt temperature limits. Discuss the derivation and justify the above proposed acceptance criterion for the fuel melt temperature limits that are specific to REA application. <u>Follow-up Items</u> • Fuel melt limit: Section 6.8.3 (PDF page 189/361) of ANP-10338P-A (December 2017) discusses the effects of the melt uncertainty and the temperature prediction uncertainty on the melt temperature function for the GAIA fuel. - Derivation of the melt temperature limit of 4754°F for the new GAIA fuel. - Derivation of the revised melt temperature function of fuel burnups. • Please add FS1-0004682 to the audit portal. • Please provide additional information justifying that the subject best estimate fuel melt temperature relationship is acceptable for deriving the fuel melt temperature limits proposed to be used in the rod ejection analysis discussed in the LAR.
C.	<u>Application of ANP-10338-P-A to GAIA Fuel in MPS3 Cores</u> Section 3.4 of Attachment 1 to the LAR dated October 30, 2023, discusses the application of the REA methodologies in ANP-10338-P-A to GAIA fuel in MPS3. It addresses the compliance with the limitations and conditions (L&C) imposed in the SEs approving the TRs applicable to REA application. Please provide the following information related to the L&C compliance.

1. Compliance with a L&C of ANP-10342, “GAIA Fuel Assembly Mechanical Design”

   In section 3.4 of Attachment 1, the licensee indicates that an L&C of ANP-10342 is applicable to the REA application. The L&C states that the most up-to-date guidance and analytical limits should be considered when demonstrating acceptable performance of GAIA under reactivity-initiated accident conditions and highlights the recently issued REA guidance in RG 1.236. Also, the licensee indicates that the application of the REA methodology is compliant with RG 1.236 and thus, satisfies the L&C.

   Section 2.2.1 of RG 1.236 provides guidance for selection of pressurized-water reactor (PWR) REA initial conditions. Specific guidance for selection of the initial conditions important to the REA analysis is discussed in sections 2.2.1.1 through 2.2.1.13.

   Please provide a discussion to show that the REA analysis for MPS3 cores with GAIA meets each PWR REA initial condition in sections 2.2.1.1 through 2.2.1.13 of RG 1.236.

   Follow-up Items

   - REA initial conditions of RG 1.236
     - Discussion how each of the above initial conditions are met.
     - Discussion of documenting the information addressing compliance with L&C for ANP-10338P-A.

2. Compliance with L&Cs of the AREVA TR Related to REA Analysis

   On page 15 of 25 of Attachment 1, the licensee indicates that one deviation was taken from the NRC-approved ARCADIA rod ejection accident (AREA) methodology. The deviation is included in Attachment 4 of the LAR as Proprietary INSERT 1

   Discuss the effect of the adopted deviation on the stated methodology and justify that it remains acceptable for REA analysis.

3. Calculated values for MPS3 AREA analysis

   On page 15 of 25 of Attachment 1, the licensee states that “MPS3 AREA analysis results demonstrate margin to the limits for fuel temperature, fuel rim temperature, enthalpy, and enthalpy rise. Departure from Nucleate Boiling (DNB) fuel rod failures are predicted, but the failure total remains within the assumptions of the current REA radiological analysis described in MPS3 FSAR [final safety analysis report] Chapter 15.4.8”.

   Please provide the values of the calculated peak fuel temperature, fuel rim temperature, enthalpy, and enthalpy rise to show that the values meet the applicable limits for the REA analysis. Also, discuss how the total number of DNB failure rods was calculated and specify the calculated total number of

	failure rods to show it is less than the number assumed in the current REA radiological analysis described in MPS3 FSAR. 4. REA Overpressure Analysis On page 15 of 25 of Attachment 1, the licensee states that "if AREA overpressure analysis were performed, it would produce a reduced pressure response compared to the existing analysis described in the FSAR". Please provide rationale or analysis to support the quoted statement related to the AREA overpressure response bounded by that in the FSAR. <u>Follow-up Item</u> • Document the summary in Section 5.4 of ANP-4058 and the sample calculation in Section A-4 of ANP-10338 if it is applicable to the GAIA fuel at MPS3. 5. Mixed-Core Application of MPS3 REA Analysis On page 16 of 25 of Attachment 1, the licensee states that "the MPS3 REA analysis incorporates a conservative thermal-hydraulic penalty that accommodates mixed-core changes in flow distribution". Please provide the value of the conservative mixed-core penalty factor, discuss how the value of the conservative penalty factor was determined and justify the use of the value of the penalty factor in the REA analysis. <u>Follow-up Item</u> • <u>Transition Core penalty (TCP)</u> - Use of the subchannel codes: COBRA-FLX vs VIPRE-D, - Derivation of TCP, - Derivation of the deterministic design Limit (DDL) limit used for REA, - Different values of the TCPs (Section 3.2 of the LAR), and - DDL (per other references). 6. Document of the Results of MPS3 AREA Analysis On page 16 of 25 of Attachment 1, the licensee states that "the report summarizing the results of the MPS3 AREA analysis for GAIA fuel are available for USNRC audit." Please load the subject report to the licensee's portal for the NRC staff to audit.
D.	Provide clarification for the following topics: • DNBR Evaluation methodology and transition core penalty calculations • Subchannel code modeling • Uncertainty analysis

	• Application of VIPRE-D/ORFEO-GAIA and VIPRE-D/ORFEO-NMGRID CHF code/correlation • Monte Carlo calculations (Follow-up items) • RCS flow rates, • Numbers of state points for a specified power level, and • Mixed core penalty factor.

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