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December 28, 2022

10 CFR 50.4

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: Unit 1 Cycle 14 MELLLA+ Eigenvalue Tracking Data

- Reference:
1. Letter from Tennessee Valley Authority (TVA) dated February 23, 2018, "Proposed Technical Specifications (TS) Change TS-510 - Request for License Amendments - Maximum Extended Load Line Limit Analysis Plus," (ML18079B140)
 2. Letter from Nuclear Regulatory Commission (NRC) to TVA dated December 26, 2019, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Issuance of Amendment Nos. 310, 333, and 298 Regarding Maximum Extended Load Line Limit Analysis Plus (EPID L-2018-LLA-0048)," (ML19210C308)

In Reference 1, TVA informed the NRC that it would evaluate and submit cycle-specific eigenvalue tracking data after the first full operating Maximum Extended Load Line Limit Analysis Plus (MELLLA+) cycle for each unit using AREVA (Framatome) methods (e.g., not MIP criterion). The enclosure provides this information for Browns Ferry Nuclear Plant, Unit 1, Cycle 14, which was completed in September 2022.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Christopher L. Vaughn, Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

A handwritten signature in black ink, appearing to read 'Manu Sivaraman', is written over a light blue horizontal line.

Manu Sivaraman
BFN Site Vice President

U.S. Nuclear Regulatory Commission
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Enclosure: Browns Ferry Unit 1 MELLLA+ Eigenvalue Tracking Report

cc (w/ Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

ENCLOSURE

**Browns Ferry Nuclear Plant
Unit 1**

Browns Ferry Unit 1 MELLLA+ Eigenvalue Tracking Report

See Enclosed

Tennessee Valley Authority



Browns Ferry Unit 1

MELLLA+ Eigenvalue Tracking Report

BFE-4763, Revision 0

December 2022

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1. Purpose

The purpose of this report is to document the fulfillment of Limitation and Condition (L&C) 9.23 for NEDC-33173P (Reference 1) for Browns Ferry Unit 1 as agreed upon in Reference 2. This limitation states:

In the first plant-specific implementation of MELLLA+, the cycle-specific eigenvalue tracking data will be evaluated and submitted to NRC to establish the performance of nuclear methods under the operation in the new operating domain. The following data will be analyzed:

- *Hot critical eigenvalue,*
- *Cold critical eigenvalue,*
- *Nodal power distribution (measured and calculated TIP comparison),*
- *Bundle power distribution (measured and calculated TIP comparison),*
- *Thermal margin,*
- *Core flow and pressure drop uncertainties, and*
- *The minimum critical power ratio importance parameter Criterion (e.g., determine if core and fuel design selected is expected to produce a plant response outside the prior experience base).*

Provision of evaluation of the core-tracking data will provide the NRC staff with bases to establish if operation at the expanded operating domain indicates: (1) changes in the performance of nuclear methods outside the EPU experience base; (2) changes in the available thermal margins; (3) need for changes in the uncertainties and NRC-approved criterion used in the SLMCPR methodology; or (4) any anomaly that may require corrective actions.

Based on Reference 3, the minimum critical power importance parameter (MIP) Criterion will not be provided. The NRC staff previously determined that submittal of the MIP was not necessary. That NRC staff's determination was generic and is applicable to Framatome methods as well.

2. Analysis

Browns Ferry Nuclear Plant Unit 1 completed its first full cycle with MELLLA+, BF1C14, in September 2022. For each metric being compared, data from the previous three cycles will be provided as a basis for comparison.

The eigenvalues at cold and hot reactor conditions are presented in the attached plots as a function of cycle exposure. The thermal margins (MAPRAT, MFDLRX, and MFLCPR) are also presented as a function of cycle exposure. The definitions of the thermal margin parameters are as follows:

- MAPRAT: Maximum ratio of bundle measured Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) to the appropriate limit.
- MFDLRX: Maximum fraction of limiting Linear Heat Generation Rate (LHGR) to the Fuel Design Limit (FDL).
- MFLCPR: Maximum fraction of limiting Critical Power Ratio (CPR).

The ratio of online core monitoring systems (Powerplex-XD) to offline evaluation (Microburn-B2) or “bias” is presented. The power distributions assessment uses nodal and radial Traversing In-Core Probe (TIP) statistics, consistent with Reference 4, from plant measured/calculated data as a function of exposure, core average void fractions, and power-to-flow ratio (P/F in units of MWth/Mlbm/hr) The plot of core flow and pressure drop uncertainties is presented as a function of P/F ratio.

For convenience and better visualization, the MELLLA+ values plotted (BF1C14 data) are presented in red squares.

3. Conclusions

The results provided demonstrate methods performance in the MELLLA+ domain continues to meet expectations set by prior submittals and historic data at non-MELLLA+ conditions. Therefore, the intent of L&C 23 has been satisfied and no further reporting is required for Browns Ferry Unit 1.

4. References

1. NEDC-33173P-A, Revision 4, "Applicability of GE Methods to Expand Operating Domains Licensing Topical Report," November 2012 (ADAMS Accession No. ML123130130)
2. Letter from the NRC to Tennessee Valley Authority, December 26, 2019, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Issuance of Amendment Nos. 310, 333, and 293 Regarding Maximum Extended Load Line Limit Analysis Plus (EPID L-2018-LLA-0048)" (ADAMS Accession No. ML19210C308).
3. Letter from the NRC to GE-Hitachi Nuclear Energy Americas, November 20, 2015, "Response to GE Hitachi Nuclear Energy Letter MFN 15-066 Dated August 26, 2015 – Clarification of Limitation and Condition 23 for NEDC-33173P, "Applicability of GE methods to Expanded Operating Domains" (TAC No. MF6665)" (ADAMS Accession No. ML15292A421).
4. EMF-2158(P)(A), Revision 0, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2," October 1999.























