From: Green, Kim
Sent: Friday, June 3, 2022 1:30 PM
To: Williams, Gordon Robert
Subject: Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Request for Additional Information re LAR to Use Advanced Framatome Methodologies in Support of ATRIUM 11 Fuel (EPID L-2021-LLA-0132)
Attachments: Browns Ferry ATRIUM 11 RAIs 06-02-22_Redacted.pdf

Dear Mr. Williams,

By application dated July 23, 2021, as supplemented by letter dated August 2, 2021 (Agencywide Documents Access and Management System Accession No. ML21204A128 and ML21218A192, respectively), the Tennessee Valley Authority (TVA) submitted a license amendment request for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. Specifically, TVA requested changes to Brown Ferry Technical Specifications (TS) 5.6.5, ''Core Operating Limits Report (COLR),'' to allow application of Advanced Framatome Methodologies for determining core operating limits in support of loading Framatome fuel type ATRIUM 11. Other conforming changes to the methodologies in TS 5.6.5 are proposed, as well as the deletion of Note F from TS Table 3.3.1.1-1, to reflect the transition from ATRIUM 10XM fuel to ATRIUM 11 fuel. The proposed amendments would also adopt Technical Specifications Task Force (TSTF) Traveler TSTF-564, ''Safety Limit MCPR [Minimum Critical Power Ratio],'' to revise the TS safety limit on MCPR (SLMCPR). Additionally, TS 5.6.5 would be revised to require the SLMCPR value to be included in the COLR.

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing TVA's application and has identified areas where additional information is needed to complete its review. A draft RAI was previously shared with you via the BOX – Enterprise File Synchronization and Sharing service (BOX-EFSS) application on May 19, 2022, due to the proprietary nature of some of the requests. At TVA's request, a clarification call was held on June 2, 2022, to clarify the NRC staff's draft RAI. As a result of the clarification call, it was determined that the first paragraph of RAI 13 did not contain proprietary information; therefore, the proprietary markings for this paragraph have been removed. No other changes were made to the RAI. The redacted, non-proprietary version of the RAI is attached. The version containing proprietary information will be transmitted to you via the BOX-EFSS.

As requested, a response to the attached RAI (non-proprietary) is requested no later than 45 days from the date of this email.

The NRC staff considers that timely responses to RAIs help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. If circumstances result in the need to revise the requested response date, please me at (301) 415-1627 or via email at Kimberly.Green@nrc.gov.

Sincerely,

Kimberly Green, Sr. Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Hearing Identifier: NRR_DRMA
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"Williams, Gordon Robert" <grwilliams1@tva.gov>
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LICENSE AMENDMENT REQUEST TO REVISE TS 5.6.5.b REGARDING APPLICATION OF

ADVANCED FRAMATOME METHODOLOGIES AND ADOPTION OF TSTF-564, REVISION 2

IN SUPPORT OF ATRIUM 11 FUEL

REQUEST FOR ADDITIONAL INFORMATION

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260, 50-296

By letter dated July 23, 2021 (ADAMS Accession No. ML21204A128) to the U.S. Nuclear Regulatory Commission (NRC), the Tennessee Valley Authority (TVA, or the licensee) submitted a license amendment request (LAR) for the Browns Ferry Nuclear Plant Units 1, 2, and 3 (Browns Ferry). The proposed amendment would revise Browns Ferry Technical Specification (TS) 5.6.5.b, "Core Operating Limits Report (COLR)," to allow the application of advanced Framatome, Inc., methodologies for determining the core operating limits in support of loading of the Framatome, Inc., ATRIUM 11™ fuel type into the Browns Ferry cores. The proposed amendment revises the TS safety limit (SL) on minimum critical power to reduce the need for cycle-specific changes to the value while still meeting the regulatory requirement for an SL.

After reviewing the LAR the NRC staff identified areas where additional information is needed to complete its review. The following additional information is requested.

Proprietary information is identified by text in bold font enclosed within double square brackets.
[[This is an example.]]

SNSB RAI 1

Regulatory Basis:

Atomic Energy Commission (AEC) CRITERION 6 - REACTOR CORE DESIGN (CATEGORY A) states:

> The reactor core shall be designed to function throughout its design lifetime, without exceeding acceptable fuel damage limits which have been stipulated and justified. The core design, together with reliable process and decay heat removal systems, shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations which can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all offsite power.

Request:

In ANP-3857P/NP, Revision 2, “Design Limits for Framatome Critical Power Correlations,” Table 1, for the use of the critical power correlation in topical report ANP-10335P-A[1] for ATRIUM 11 fuel, ANP-10335P-A contains limitations and conditions in Section 4.0 of the NRC’s safety evaluation. However, it is not apparent that Framatome has addressed the L&Cs for this application. Provide a disposition for each L&C.

<u>SNSB RAI 2</u>

Regulatory Basis:

Same as in SNSB RAI 1.

Request:

ANP-3859, Section 3.2 states that **[[**

]]

However, no explanation is provided to support this statement. Explain why the **[[**
]] in the above determination.

<u>SNSB RAI 3</u>

Regulatory Basis:

Same as in SNSB RAI 1

Request:

In ANP-3905, Section 7.2, Framatome states that for single loop operation (SLO) a 0.85 multiplier is applied to the two-loop maximum average planar linear heat generation rate (MAPLHGR) limit resulting in an SLO MAPLHGR limit of **[[ ]]** kW/ft. However, no explanation is provided for the selection of this multiplier. Explain how the multiplier 0.85 was selected to determine the maximum MAPLHGR for SLO.

<u>SNSB RAI 4</u>

Regulatory Basis:

Same as in SNSB RAI 1

Request:

In ANP-3905, Appendix A, limitation and condition 11 states:

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[1] Framatome, Inc., Topical Report ANP-10335P-A, Revision 0, *ACE/ATRIUM 11 Critical Power Correlation*, May 2018 (ADAMS Package Accession No. ML18207A382).

> Plant-specific licensing applications referencing the AURORA-B LOCA evaluation model **[[**
> **]]**

The vendor's disposition is as follows:

> BWR [Boiling Water Reactor] fuel rods are **[[**
> **]].**

Provide the basis for **[[**

]].

SNSB RAI 5

Regulatory Basis:

10 CFR 50.46(b)(1), Peak cladding temperature. The calculated maximum fuel element cladding temperature shall not exceed 2200° F.

Request:

ANP-3905, Table 4.5 states the low pressure coolant injection (LPCI) injection valve stroke time to be 40 seconds.

Referring to ANP-3905, Table 5.1, the single failure (SF) cases SF-BATT [SF-battery], SF-DGEN [SF-diesel generator], SF-HPCI [SF-high pressure coolant injection], and SF-ADS [SF-automatic depressurization system] use either one LPCI (two pumps) loop or two LPCI (four pumps) loops.

During normal operation, in the scenario in which the residual heat removal (RHR) system is placed in the suppression pool cooling mode or flow test mode, the RHR system test line isolation valve through which water returns to the suppression pool is open. The Browns Ferry Updated Final Safety Analysis Report (UFSAR), Amendment 29, section 7.4.3.5.4 states the automatic closing time for this valve for LPCI operation is 90 seconds.

In the analysis based on the single failures noted above, for a loss-of-coolant (LOCA) in the scenario while the RHR system is in the suppression pool cooling mode during normal operation, with the return flow through the test line isolation valve, the unit is placed in Limiting Condition of Operation (LCO) 3.6.2.1. During the period in the which the unit is in LCO, the design basis single failure assumption is temporarily relaxed. However, in the LPCI flow test mode (Surveillance Requirement 3.5.1.6), there is no LCO associated with this mode and, therefore, the design basis does not allow a single failure while operating in this mode.

While RHR is operating in the LPCI flow test mode, the test line isolation valve should automatically close on receiving a LOCA signal in 90 seconds, while the LPCI injection valve fully opens in 40 seconds from the same signal. During the 50 seconds time difference (between the closing time of test line isolation valve and the opening time of the LPCI injection valve) some of the LPCI flow will bypass to the suppression pool and, therefore, the reactor will not receive the fully rated LPCI flow.

In the analysis based on the single failures noted above, for a LOCA in the scenario while the RHR system is in the test mode during normal operation, with the test line isolation valve partially open for 50 seconds, provide the following:

(a) Confirm that partially closed (instead of fully closed) test line isolation valve was considered by not crediting the fully rated LPCI flow. Provide the LPCI flow rate credited in the first 90 seconds from the LOCA signal and the fully rated LPCI flow credited after 90 seconds from LOCA signal.

(b) If the fully rated constant LPCI flow is used in the analyses starting at 40 seconds from LOCA initiation, justify.

SNSB RAI 6

Regulatory Basis:

Same as in SNSB RAI 1

Request:

ANP-3904, Table 3.1, “Disposition of Events Summary for Introduction of ATRIUM 11 Fuel at Browns Ferry,” lists two events which state the events are expected to be non-limiting. The events are UFSAR, section 14.5.2.5, “Turbine bypass valves failure following turbine trip (TTNB), high power,” and UFSAR, section 14.5.2.6, “Turbine bypass valves failure following turbine trip (TTNB), low power.” The disposition status of these events is described as “Address initial reload” and “No further analysis required” respectively and are stated to be *generally bounded* [emphasis added] by the FSAR Section 14.5.2.2 event. However, no information is provided explaining how these events are verified to be non-limiting for each reload, or justifying why such a verification is not necessary. If the events do not prove to be non-limiting, explain the process to ensure protection for each reload.

SNSB RAI 7

Regulatory Basis:

Same as in SNSB RAI 1

Request:

ANP-3904, section 4.1.4 provides the American Society for Mechanical Engineers (ASME) maximum overpressurization analyses based on UFSAR Section 14.5.2.7 MSIV closure event. As stated in ANP-3904, Table 3.1, in the ‘Comments’ column, this event is bounded by the

FSAR Section 14.5.2.2.4 LNRB with EOC-RPT-OOS [generator load rejection no bypass with end of cycle recirculation pump trip out of service] event which is a potentially limiting abnormal operational transient (AOT). Provide reason(s) for not performing the overpressurization analysis based on the more limiting UFSAR 14.5.2.2.4 AOT event.

SNSB RAI 8

Regulatory Basis:

The Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (SRP, NUREG-0800), Section 4.2, "Fuel System design" (ADAMS Accession No. ML070740002), Section 4.3, "Nuclear Design", and Section 4.4, "Thermal and Hydraulic Design" (ADAMS Accession No. ML070740003), provide regulatory guidance for the review of fuel rod cladding materials, the fuel system, the design of the fuel assemblies and control systems, and thermal and hydraulic design of the core.

According to SRP Section 4.2, the fuel system safety review provides assurance that:

- The fuel system is not damaged as a result of normal operation and Anticipated Operational Occurrences (AOOs)
- Fuel system damage is never so severe as to prevent control rod insertion when it is required,
- The number of fuel rod failures is not underestimated for postulated accidents, and Coolability is always maintained.

1967 Atomic Energy Commission (AEC) CRITERION 6 - REACTOR CORE DESIGN (CATEGORY A) – See SNSB RAI 1.

Request:

ANP-3860P defines criteria for fuel assembly lift-off as, "The fuel shall not levitate under normal operating or AOO conditions. Under postulated accident conditions, the fuel shall not become disengaged from the fuel support. These criteria assure control blade insertion is not impaired."

(a) Provide a summary of key steps in calculations of assembly lift-off during normal operating conditions for both ATRIUM 11 core and mixed core conditions.

(b) For faulted or accident conditions, such as a LOCA, provide a summary of procedures with a typical calculation describing how the criteria for assembly lift-off is satisfied.

SNSB RAI 9

Regulatory Basis:

See SNSB RAI 8.

Request:

With regard to rod bow, Section 3.3.5 of ANP-3860P states that **[[**

]] Provide details of how this correlation is developed. Also describe how this correlation is used to quantify the creep as a function of fuel exposure.

<u>SNSB RAI 10</u>

Regulatory Basis:

See SNSB RAI 8.

Request:

Section 3.1 of ANP-3866P states, **[[**

]]

(a) Describe the neutronic impact, if any, of **[[ ]]**.

(b) Describe the impact of **[[ ]]** on fission gas release, fuel densification and swelling, corrosion, and fuel creep.

<u>SNSB RAI 11</u>

Regulatory Basis:

See SNSB RAI 8.

Request:

Section 3.2 of ANP-3866P describes application of RODEX4 and statistical methodology for thermal-mechanical response of the fuel rod surrounded by coolant. Provide the following information:

(a) Explain how **[[**
]]

(b) Explain the term **[[ ]]**

(c) Explain how **[[**
]] are calculated.

(d) Describe the methodology used for power measurement and operational uncertainties, manufacturing uncertainties, and model uncertainties. Provide a summary of these uncertainties.

SNSB RAI 12

Regulatory Basis:

See SNSB RAI 8.

Request:

Section 3.3.7 of ANP-3866P states that **[[** **]]** at Browns Ferry. Provide details of how this limit is implemented at Browns Ferry.

SNSB RAI 13

Regulatory Basis:

Same as in SNSB RAI 1

Request:

In the NRC staff SE for ANP-10332P-A, limitation and condition #16 states that plant licensing applications referencing the AURORA-B LOCA Evaluation Model shall justify that the input conditions assumed in the analysis are bounding across the entire approved operating domain.

[[

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