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

July 21, 2016

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 - REQUEST FOR ADDITIONAL INFORMATION RELATED TO LICENSE AMENDMENT REQUEST REGARDING EXTENDED POWER UPRATE (CAC NOS. MF6741, MF6742, AND MF6743)

Dear Mr. Shea:

By letter dated September 21, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15282A152), as supplemented by letters dated November 13, December 15 (two submittals), and December 18, 2015, Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request (LAR) for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. The proposed amendment would increase the authorized maximum steady-state reactor core power level for each unit from 3,458 megawatts thermal (MWt) to 3,952 MWt. This LAR represents an increase of approximately 20 percent above the original licensed thermal power level of 3,293 MWt, and an increase of approximately 14.3 percent above the current licensed thermal power level of 3,458 MWt.

In addition, by letter dated April 14, 2016, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI). The licensee, by letter dated April 27, 2016, responded to the requested information.

The NRC staff reviewed the licensee's submittals and determined that a followup RAI is needed. On July 1, 2016, the NRC staff forwarded, by electronic mail, a draft of the staff's follow up RAI to TVA. On July 7, 2016, TVA informed the NRC staff, by the phone, that no clarification call is needed. The official question is found in the enclosed RAI. This request was discussed with Mr. Daniel Green of your staff, and it was agreed that TVA would respond by August 12, 2016. In addition, Mr. Green confirmed that the enclosed RAI does not contain any sensitive information.

If you have any questions, please contact me at 301-415-1447 or Farideh.Saba@nrc.gov.

Sincerely,

Farideh E Saba

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, and 50-296

Enclosure:
Request for Additional Information

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REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST REGARDING EXTENDED POWER UPRATE

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3

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

By letter dated September 21, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15282A152), as supplemented by letters dated November 13, December 15 (2 letters), and December 18, 2015 (ADAMS Accession Nos. ML15317A361, ML15351A097, ML15351A113, and ML15355A413, respectively), Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request (LAR) for Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3. The proposed amendment would increase the authorized maximum steady state reactor core power level for each unit from 3,458 megawatt thermal (MWt) to 3,952 MWt. This LAR represents an increase of approximately 20 percent above the original licensed thermal power level of 3,293 MWt, and an increase of approximately 14.3 percent above the current licensed thermal power (CLTP) level of 3,458 MWt.

In addition, by letter dated April 14, 2016 (ADAMS Accession No. ML16085A079), the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI). The licensee, by letter dated April 27, 2016 (ADAMS Accession No. ML16118A298), responded to the requested information.

The NRC staff from the Probabilistic Risk Assessment Licensing Branch (APLA), Division of Risk Assessment, Office of Nuclear Reactor Regulation, reviewed the information the licensee provided and determined that the following additional information is required in order to complete the evaluation.

APLA-RAI 09.01

In RAI No. APLA-RAI 09, dated April 14, 2016, the NRC staff requested the licensee to explain how several human error probabilities (HEPs) were quantified for both the extended power uprate (EPU) and CLTP in order to confirm the reasonableness of these calculations and to understand why the increase in some HEPs are much larger than others. In response to APLA-RAI 09 dated April 27, 2016, the licensee discussed the quantification of these HEPs for both the EPU and CLTP. The response stated for human failure event (HFE) HFFA0ASD_RCIC that "the dependency levels are higher [a medium dependency was assigned for the CLTP case and a high dependency was assigned for the EPU case] for the abandonment action due to the longer execution time and stress levels." It is not clear why the HEP for HFFA0ASD_RCIC is increased by only a factor of 1.15 at the CLTP level to the EPU level, while HEP for HFEs HFA_0002RPV_LVL and HFA_0HCIINIT30 are increased by much larger factors (i.e., a factor of 2.76 and 2.04, respectively).

Enclosure

The staff observed that the execution analysis in the Electric Power Research Institute (EPRI) human reliability analysis (HRA) calculation sheet for HFFA0ASD_RCIC includes 9 procedure steps, with recovery considered only in procedure step 1. Procedure steps 2 through 9, which are considered "high" stress, did not credit recovery because of an assumption made for the HEP of each step (i.e., "it is better to use item Ref. 8a [that is a HEP value of 2.7E-04] even though it is for normal stress and then not credit a recovery step"). Not crediting recovery in procedure steps 2 through 9 for HFFA0ASD_RCIC causes the HEPs associated with these steps to be the same between the CLTP and EPU. This results in a smaller increase in total HEP for HFFA0ASD_RCIC, between the CLTP and EPU cases, than that had recovery been credited, potentially leading to underestimating the change in risk. When recovery is credited in each procedure step, the EPU HEP for HFFA0ASD_RCIC could be 3 times larger (not 1.15 times larger as currently indicated by Attachment 44 of the EPU LAR) than that for the CLTP case. This issue may also apply to other HFEs considered in the EPU risk evaluation, such as those HFEs identified in Part 1 below.

The staff requests the licensee to address the following:

a. Provide the detailed HRA calculation sheets (e.g., as generated by the EPRI HRA calculator) for the following HFEs for both the CLTP and EPU cases:

   - HFA_0003PMP_START ("Operator fails to restart RFW [reactor feedwater] after Level 8 trip")
   - HFA_0071L8RESTART ("Operator fails to restart RCIC [reactor core isolation cooling] after Level 8 trip")
   - HFA_0073L8RESTART ("Operator fails to restart HPCI [high pressure coolant injection] after Level 8 trip")
   - HFFA_1SHV0760540_35 ("Local action - close 1-SHV-076-0540 (2- and 3- for Units 2 and 3) within 35 minutes")
   - HFFA0268480CRSTIE ("Failure to transfer deenergized 480V board to alternate supply (fire)")
   - HFFA0ASD_RCIC ("Operator fails to start RCIC")

b. For each internal events and fire HFE considered in the EPU risk evaluation (i.e., HFEs in Tables 4-4 and 4-9 of Attachment 44 of the EPU LAR) that have a different dependency level between the CLTP and EPU cases, confirm that recovery is appropriately represented in the HFE's cognitive analysis and execution analysis such that the total HEP is realistically estimated for the CLTP and EPU cases. If it is not, then update the associated HEPs for the CLTP and EPU cases to appropriately address recovery, and provide the updated HEPs along with an explanation of how they were changed (provide sufficient detail and numerical values to understand the basis for the updated HEPs).

c. If changes were made to the HEPs in Part b of this RAI, then provide:

1. Updated risk results in Sections 5.1 ("Internal Event Results"), 5.2 ("Fire Risk Results"), and 5.6 ("Total Risk") in Attachment 44 of the EPU LAR, as applicable. If Regulatory Guide (RG) 1.174 risk acceptance guidelines are exceeded, then please provide a detailed justification to support the conclusion that no "special circumstances" are created by the proposed EPU, include a discussion of which metrics are exceeded and the conservatisms in the analysis and the risk significance of these conservatisms.

2. Updated risk results in Table 8-1 ("Summary Risk Results for the Combined Sensitivity Study") of the response to APLA-RAI 08, dated April 27, 2016. If RG 1.174 risk acceptance guidelines are exceeded, then provide a detailed justification to support the conclusion that no "special circumstances" are created by the proposed EPU, include a discussion of which metrics are exceeded and the conservatisms in the analysis and the risk significance of these conservatisms.

If you have any questions, please contact me at 301-415-1447 or Farideh.Saba@nrc.gov.

Sincerely,

/RA/

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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ADAMS Accession No.: ML16194A229 *by e-mail

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