



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-079

May 11, 2016

10 CFR 50.90

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 15, Responses to Requests for Additional Information**

- References:
1. Letter from TVA to NRC, CNL-15-169, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU)," dated September 21, 2015 (ML15282A152)
  2. Letter from NRC to TVA, "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)," dated April 20, 2016 (ML16104A245)

By the Reference 1 letter, Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for the Extended Power Uprate (EPU) of Browns Ferry Nuclear Plant (BFN) Units 1, 2 and 3. The proposed LAR modifies the renewed operating licenses to increase the maximum authorized core thermal power level from the current licensed thermal power of 3458 megawatts to 3952 megawatts. During their technical review of the LAR, the Nuclear Regulatory Commission (NRC) identified the need for additional information. The Reference 2 letter provided a NRC Request for Additional Information (RAI) related to vibration monitoring. The due date for the response to the NRC RAI provided by the Reference 2 letter is May 16, 2016. The enclosure to this letter provides the responses to the RAIs included in the Reference 2 letter. As discussed with the NRC Project Manager on May 4, 2016, a supplement to the BFN EPU LAR Attachment 45, Flow Induced Vibration Analysis and Monitoring Program, will be submitted to NRC by June 29, 2016. The supplement will correct recently discovered errors associated with acceptance criteria in Tables 3-1, 3-2, and 3-3 of BFN EPU LAR Attachment 45.

TVA has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in the Reference 1 letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the supplemental information in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed license amendment. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Alabama State Department of Public Health.

There are no new regulatory commitments associated with this submittal. If there are any questions or if additional information is needed, please contact Edward D. Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 11th day of May 2016.

Respectfully,

A handwritten signature in black ink, appearing to read "J. W. Shea", followed by a small flourish.

J. W. Shea  
Vice President, Nuclear Licensing

Enclosure: Response to NRC Request for Additional Information EMCB-VIB-RAI 1

cc:

NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant  
State Health Officer, Alabama Department of Public Health

**ENCLOSURE**

**Responses to NRC Request for Additional Information EMCB-VIB-RAI 1**

## ENCLOSURE

### EMCB-VIB-RAI 1

*In Attachment 45, "Flow Induced Vibration Analysis and Monitoring Program," of letter dated September 21, 2015, the licensee described a flow induced vibration analysis and monitoring program. Provide clarification for the following.*

- a. In Section 3.0 of Attachment 45, clarify that the vibration acceptance criteria limits provided in Tables 3-1, 3-2, 3-3, and 3-4 correspond to level 1 or level 2 acceptance limits.*
- b. In Section 4.4 of Attachment 45, the licensee mentioned level 1 and level 2 criteria limits. Describe what percentage of level 1 is level 2 limit.*
- c. In Section 4.2.1 of Attachment 45, it appears that main steam and feed water piping vibration limits are based on consideration of frequencies up to 50 Hertz (Hz). Address if 50 Hz cut off is based on operating experience. Also, describe if any correction or increase for any contribution from higher modes (such as zero period acceleration effects) is applied.*

### **TVA Response:**

- a. The vibration acceptance criteria limits provided in Tables 3-1, 3-2, 3-3, and 3-4 of Attachment 45 of the License Amendment Request (LAR) correspond to Level 1 acceptance limits. This is indicated in Section 4.4 of Attachment 45 of the LAR by the statement "The Level 1 criteria correspond to the calculated vibration limits."
- b. Level 2 limits will be 80% of Level 1 limits, which will provide sufficient warning of any potential challenge to the Level 1 limits as power is increased.
- c. The 0 to 50 Hz frequency range used for developing the acceptance criteria is based on operating experience and piping system structural dynamics. The predominant frequencies of piping flow-induced vibrational displacements tend to be in the 0 to 30 Hz range, which corresponds to piping system flexible (i.e., bending) modes. The 0 to 50 Hz frequency range used for developing the acceptance criteria conservatively envelopes piping system flexible mode responses. Rigid mode (i.e., modes above the cutoff frequency) responses result in insignificant displacements relative to flexible mode responses and therefore, do not contribute significantly to pipe bending stress.

Harmonic vibration relationships, which are representative of steady state vibration, illustrate how vibrational displacements decrease as frequency increases. For harmonic vibration, displacement is equal to acceleration divided by angular frequency squared. As an example, a 1g acceleration at 10 Hz corresponds to approximately 100 mils zero-to-peak displacement; whereas, a 1g acceleration at 100 Hz corresponds to approximately 1 mil zero-to-peak displacement.

## **ENCLOSURE**

Because vibrational displacements and corresponding pipe stresses at frequencies above 50 Hz are not anticipated to be significant relative to the displacements and corresponding pipe stresses at frequencies below 50 Hz, adjustments to the acceptance criteria are not made to account for contributions from frequencies above 50 Hz. Note that the measured displacements that are compared to the acceptance criteria will include the frequency content above 50 Hz, so the contributions from those frequencies are inherently considered when evaluating the data. The frequency content of the measured displacements will also be reviewed in the normal course of data processing to confirm the applicability of the frequency range used as the basis for the acceptance criteria.