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

November 12, 2008

Mr. William R. Campbell, Jr.
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1 AND 2 – REQUEST FOR ADDITIONAL INFORMATION FOR EXTENDED POWER UPRATE - ROUND 22 (TAC NOS. MD5262 AND MD5263) (TS-431 AND TS-418)

Dear Mr. Campbell:

By letter dated June 24, 2004, the Tennessee Valley Authority (TVA, the licensee) submitted an amendment request for Browns Ferry Nuclear Plant (BFN), Unit 2 and 3, as supplemented by letters dated August 23, 2004, February 23, April 25, June 6, and December 19, 2005, February 1 and 28, March 7, 9, 23 and 31, April 13, May 5 and 11, June 12, 15, 23 and 27, July 6, 21, 24, 26, and 31, December 1, 5, 11 and 21, 2006, January 31, February 16, and 26, and April 6, 18 and 24, March 6, July 27, August 13, and 21, September 24, November 15 and 21, and December 14, 2007; January 25, February 11 and 21, March 6, April 4 and 9, May 1, June 16, August 15, September 2 and 19, and October 3 and 11, 2008. The proposed amendment would change the BFN operating licenses for Units 1 and 2 to increase the maximum authorized power level by approximately 15 percent.

A response to the enclosed Request for Additional Information (RAI) is needed before the Nuclear Regulatory Commission staff can complete the review. This request was discussed with Mr. James Emens of your staff on November 5, 2008, and it was agreed that TVA would respond by December 15, 2008.

If you have any questions, please contact me at (301) 415-2315.

Sincerely,

/RA/
Eva A. Brown, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259 and 50-260

Enclosure:
RAI

cc w/enclosure: Distribution via Listserv

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ADAMS Accession No.: ML083120045 NRR-088

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NAME	EBrown	BClayton	KManoly	GCranston	TBoyce
DATE	11/12/08	11/12/08	11/6/08	11/6/08	11/12/08

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REQUEST FOR ADDITIONAL INFORMATION

EXTENDED POWER UPRATE

ROUND 22

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50- 259 AND 50-260

EMCB

(Units 1 and 2 only)

199./156. In the stress assessment of the Unit 1 steam dryer, Tennessee Valley Authority (TVA) has employed submodeling approach, as shown in Enclosure 6 of the letter dated June 16, 2008 for estimating the complete three-dimensional stress distribution at the two locations having the lowest alternating stress ratios: (1) the intersection between the bottom of the inner hood, stiffener and base plate, and (2) the bottom of the skirt/drain channel junction. For each of these two locations, TVA creates two submodels, one based on shell elements and the other based on solid elements. The NRC staff noted that TVA applied its submodeling approach two different ways. For the first location, TVA simulates the stress profile of the full- model analysis in the submodel using shell elements by applying static loading on a short section of the stiffener. For the second location, TVA applies the prescribed displacement at specific intervals along a vertical line in the drain channel using a submodel with shell elements and performs the 3-D analysis iteratively by changing the location of the vertical line until the stress profile in the submodel matches the stress profile of the full-model analysis. The applied loads (or displacements) from the submodel with shell elements are also applied to a corresponding submodel with solid elements. Finally, TVA determines a stress reduction factor for each location by comparing the solid submodel results to the corresponding shell submodel results (the largest ratio of the (Pm + Pb) stress intensity from the submodels) and applies it to the appropriate stresses in the full-model steam dryer analysis.

The above-described submodeling approach is not typical. In a typical submodeling approach, as employed in the general purpose finite element codes such as ANSYS and ABAQUS, the results from the full-model analysis are interpolated onto the nodes on the appropriate part of the boundary of the submodel. These nodes and any loads applied to the local region are used to perform the detailed finite element analysis of the submodel from which the stress ratios may be determined.

As TVA's submodeling approach is different than the typical approach, it is essential that the approach is validated for each of the two applications by performing the dynamics analysis for a representative structural dynamic model. Therefore, TVA is requested to provide the following:

a. A description of the representative structural dynamic model;

b. An analysis of the model using a typical submodeling approach;

c. An analysis of the model applying the TVA's submodeling approach employed to determine the stresses at the in

d. An analysis of the model using the TVA's submodeling approach employed to determine the stresses at the bottom of the skirt/drain channel junction; and,

e. A comparison of the results obtained in (b) using the typical submodeling approach with those in (c) and (d) using the TVA's approach. This should tersection between the bottom of the inner hood, stiffener and base plate; include an assessment of the validity of the TVA's submodeling approach for each of the two applications mentioned above.

200./157. As part of the presentation in the public meeting held on October 14, 2008, TVA provided the following equation for the steam line unsteady pressure at CLTP (current licensed thermal power):

$$P_{CLTP} = C_{CLTP}(CLTP - EIC_{CLTP}) - C_{LF}(LF - EIC_{LF}),$$

where P is the steam line unsteady pressure, C is the coherence factor between upper and lower locations, LF is the low flow signal, and EIC is the signal taken with zero excitation voltage.

The equation implies that the coherence factors between the upper and lower strain gage locations are the same for both the CLTP signal and the corresponding EIC signal. However, it appears to the staff that the equation may not be conservative in all cases. In the event the coherence between the EIC signals on the upper and lower arrays is 0, it appears that the coherent portion of the signals at CLTP or LF already excludes the incoherent EIC signals. Therefore, it appears that subtracting the EIC autospectra from the individual CLTP and LF signals and then multiplying by the coherence removes the EIC noise twice.

Address whether the proposed EIC noise reduction procedure removes the EIC noise twice. If the proposed procedure does, provide the means to more appropriately account for the coherence of the EIC signals.

(Unit 2 only)

For Unit 2, TVA is substituting LF (LF; 5 percent power) and EIC signals at the lower strain gage location on main steam line (MSL) 'A' for the corresponding signals at the lower strain gage location on MSL 'D' because all the strain gages on the MSL 'D' lower location are damaged. During the October 14, 2008, public meeting, it was indicated that the MSL 'A' and MSL 'D' are similar and, therefore, the substitution for the damaged strain gages is acceptable.

158. Provide the comparisons of the following data associated with MSLs 'A' and 'D':

(1) piping layouts,

(2) strain gage locations, and

(3) locations and dimensions of safety relief valves.

159. Demonstrate that (1) the filtered signals for MSL 'A' upper and MSL 'D' upper are similar for both the LF (5-percent power) and CLTP-flow conditions for Unit 2, (2) the filtered signals for MSL 'A' lower and MSL 'D' lower are similar for the CLTP flow conditions, and (3) the bump-up factors for MSL 'A' lower and MSL 'D' lower are similar.

160. On Slide 10 of the presentation in the public meeting held on October 14, 2008, TVA provided graphs of the MSL EIC signals. For example, the variable frequency drive spectral peaks are sometimes up to 4 orders of magnitude higher than the EIC signals used in the noise removal process. The EIC signals are, therefore, a very small fraction of the total dynamic input range of the measuring system. For example, if it is assumed that the measuring system is accurate within 0.1 percent of the dynamic input range, this error level is already about 10 times higher than the broad-band level of the EIC signal, which is used for noise removal. Address the uncertainties in the EIC signals while it is removing the noise from the Unit 2 CLTP signals.

161. In the information provided to date, it appears to the NRC staff that the EIC signals of Unit 2 show a high degree of anomaly and seem to be unrepeatable. For example, on Slide 14 in the presentation slides provided during the October 14, 2008, public meeting, the LF EIC signal obtained from the most recent measurements on MSL 'C' Upper in Unit 2 is higher than the total LF signal at frequencies above 130 Hz. These results of the upper strain gages on MSL 'C' appear to be incorrect because the EIC signal constitutes the electrical interference noise portion of the LF signal and, therefore, it ought to be smaller than the LF signal. Address how this anomaly will be dealt with as well as the steps that will be taken to ensure the reliability of all strain gage signals obtained at LF conditions in Unit 2.

SRXB
(Unit 1 only)

Provide a (using tables and/or figures) comparing the values of key plant parameters such as reactor pressure and reactor water level observed during the October 12, 2007, main turbine trip event from approximately 100 percent (CLTP) at 3458 megawatts thermal (MWt) with the results of the following:

a. An ODYN calculation performed at CLTP for the October 12, 2007, main turbine trip event;

b. An ODYN calculation at extended power uprate (EPU) power (3952 MWt) for a main turbine trip at a comparable core exposure as the October 12, 2007, event; and,

c. The main turbine trip event of June 9, 2007, at 80-percent CLTP (2761 MWt), and the corresponding ODYN calculation performed for that event.

In addition, provide the calculated maximum delta critical power ratio for a), b) and c).

This study should show the degree of conservatism between the maximum reactor peak pressure observed during the actual events (June 9 and October 12, 2007) and the calculated maximum vessel pressure for rated CLTP, 80-percent CLTP and rated EPU power using the transient analysis computer code used for pressurization events. In addition, the results will allow for a comparison between the calculated change in delta critical power ratio between a simulation of the actual events at CLTP (calculation a)), at 80-percent CLTP (calculation c)) and at EPU (calculation b)).

76. Explain how past Unit 1 operating experience, including the turbine trip event from 100 percent of CLTP on October 12, 2007, provides information representative of how the unit would respond to a load rejection from 100 percent of EPU conditions. In particular, address how well the modified feedwater (FW) and condensate system would maintain reactor level consistent with the design response (i.e., avoiding unnecessary emergency core cooling system actuation on low level and high pressure coolant injection isolation on high level) considering the higher power level (and associated higher FW flow) and the different timing of signals for a main-generator-initiated load rejection as opposed to a main turbine trip. Identify any component-level testing and computer modeling of plant transient response that supports proper operation of the FW system in responding to the load rejection from the EPU power level.