July 19, 2006

Mr. Karl W. Singer
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 2 AND 3 — REQUEST FOR ADDITIONAL INFORMATION FOR EXTENDED POWER UPRATE - ROUND 7 (TS-431) (TAC NOS. MC3743 AND MC3744)

Dear Mr. Singer:

By letter dated June 28, 2004, 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, and June 12, 15 and 23, 2006, Tennessee Valley Authority submitted to the U.S. Nuclear Regulatory Commission (NRC) an amendment request for Browns Ferry Nuclear Plant, Units 2 and 3. The proposed amendments would change the Units 2 and 3 operating licenses to increase the maximum authorized power level from 3458 to 3952 megawatts thermal. This change represents an increase of approximately 15 percent above the current maximum authorized power level. The proposed amendments would also change the Units 2 and 3 licensing bases to revise the credit for overpressure from 3 pounds for short-term and 1 pound for long-term, to 3 pounds for the duration of a loss-of-coolant accident, and revise the maximum ultimate heat sink temperature.

The request for additional information was informally provided to your staff on June 15, 2006. A response to the enclosed request for additional information is needed before the NRC staff can complete the review. If you have any questions, please contact me at (301) 415-2315.

Sincerely,

/RA/

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

Docket Nos. 50-260 and 50-296

Enclosures:
1. Redacted Request for Additional Information
2. Proprietary Request for Additional Information

cc w/Enclosure 1 only: See next page

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cc w/Enclosure 1 only: See next page
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NAME	EBrown	RSola for BClayton	GWilson by memo	KManoly by memo
DATE	07/18/06	07/18/06	06/21/06	06/8/06

OFFICE	LPL2-2/BC
NAME	MMarshall
DATE	07/18/06

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SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 2 AND 3 — REQUEST FOR ADDITIONAL INFORMATION FOR EXTENDED POWER UPRATE - ROUND 7 (TS-431) (TAC NOS. MC3743 AND MC3744)

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REQUEST FOR ADDITIONAL INFORMATION

EXTENDED POWER UPRATE

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 2 AND 3

DOCKET NOS. 50-260, AND 50-296

EEEB

12. In a letter dated October 3, 2005, in question EEIB-B-4, the NRC staff requested detailed information on the modification to the isophase bus cooling. As the December 19, 2005, response did not contain a sufficiently detailed discussion, address the modifications planned for the isophase bus cooling and the replaced transformers. With regards to the transformers, clarify what modification will be made to increase the rating of the main transformers and when the new transformers will be installed.

13. Since higher capacity recirculation, condensate, and condensate booster pumps are going to be installed, clarify if any modification to the cabling and protective relaying would be required because of the higher load current and provide the status and schedule for those modifications.

14. Enclosure 4, Section 6.1.1 in Enclosure 4 of the June 25, 2004, submittal, NEDC-33047P, DRF 0000-0011-1328, Revision 2, Browns Ferry Units 2 and 3 Safety Analysis Report for Extended Power Uprate, of the PUSAR, states that the generator breaker is to be modified to have a continuous rating of 36740 amperes for Units 2 and 3; however the December 19, 2005, responses to EEIB-B-4 states that no changes are required in generator breaker rating. Explain the discrepancy and provide a discussion how the continuous and short circuit ratings of the generator breaker will be increased for extended power uprate (EPU) conditions, if needed.

EEMB (Previously EMEB-B)

15. Describe the power ascension monitoring plan for steam dryer and main steam lines (MSLs).

16. Enclosure 1 of the letter dated April 13, 2006 contained the General Electric (GE) report, GE-NE-0000-0049-6652-01P, Revision 0, General Electric Boiling Water Reactor Steam Dryer Scale Model Test Based Fluctuating Load Definition Methodology, dated March 2006 (SMT Report). [ ]
Explain the modeling of surface roughness, edges, and other geometric parameters at the small scale of 1/17; potential distortions and their consequences; and the range of uncertainty in replicating the existence of the excitation mechanisms, their magnitudes,

and their frequency content. Include a discussion of why, when and how 1/6th scale models are used for modeling the safety relief valves (S/RVs).

17. [ ]because they cannot be accurately modeled at 1/17 scale. Discuss what, if any, flow-induced vibration (FIV) excitation mechanisms are precluded by this distortion.

18. As mentioned on pages 71, 74, and 114 of the SMT Report, [ ]. Explain how the waterline is modeled, changes that are planned, and the effects of potential distortions on pressures and acoustic mode shapes. The response should take into account that acoustic circuit analysis (ACA) has shown that this water-steam interface's damping significantly affects pressure predictions.

19. As mentioned on pages 70 and 75 of the SMT Report, [ ], which the report states will attenuate fluid flow oscillations. Elaborate on how this distortion will affect SMT pressures and what changes could be made to model more prototypic conditions. The reply should take into account that ACA analysis has shown that the steam dome and MSL steam damping significantly affects pressure predictions.

20. As mentioned on pages 70, 71, and 74 of the SMT Report, the array of steam separators in the reactor are described to act like a muffler and the vane bundles which provide some attenuation to acoustic waves. [ ]. Explain how these boundary conditions are represented in the SMT. Also, explain how the differences between the actual boundary conditions and those modeled in the SMT affect the pressures and acoustic mode shapes.

21. As mentioned on pages 72, 73, 75, and 104 of the SMT Report, [ ]. Also, the piping layouts between the S/RVs and the main steam isolation valves (MSIVs) are not prototypic. [ ]. Elaborate on the sensitivity of the turbulence noise excitation mechanism created by these model distortions. Include in the response similar considerations for the turbine control valves (TCVs) and turbine stop valves (TSVs). Discuss the adequacy of the modeling of these components.

22. In reference to the discussion on page 46 of the SMT Report, discuss potential periodicities created in the flow resulting from the multiple jets emanating from the top of the dryer into the steam dome.

23. In reference to the discussion on page 49 and in Appendix A of the SMT Report, explain the potential excitation mechanisms within the steam dome and their significance in term of the need to understand their source and impact. Address the dependence of these mechanisms on Reynolds number (Re) and their possible distortion in the SMT.

24. In reference to the discussion on page 138 of the SMT Report, address how the time shifts are formulated in the stress analyses using an SMT load definition [

] emergency relief valve and S/RV peaks observed in the Quad Cities Unit 2 (QC2) at different frequencies.

25. In reference to the discussion on page 140 of the SMT Report, address how the SMT and the prototype are correlated, so that normal modes are adequately modeled at all the frequencies of interest.

26. The comparison of the operating mode shapes for the pressure data in the SMT and QC2 as presented on pages beginning with page144 is not clear. Discuss this comparison in more detail.

27. a) Address why a 1:17.3 small scale model was chosen in lieu of a larger scale model (e.g.,1:8). Address the possibility of error propagation being excessive due to the scaling of the model.

    b) Discuss whether there are any friction effects that cause additional ambient noise in the plant using a saturated water vapor compared to the scaled model that uses purely dry air. Discuss whether fouling and buildup on the inside of the plant MSLs considered. Discuss whether those potential friction effects can be neglected and assumed small in the model.

    c) The pressure of air is dependent on the temperature and density where treated as an ideal gas. Discuss what temperature of air was chosen for the model, since pressure is linearly dependent on temperature. Address how the model accounts for steam at given pressures and temperatures in the plant.

28. When calculating the Re for internal flow in a circular pipe on pages A20/A30 of the SMT Report, the diameter of the pipe in the scale model should be that of the plant MSL (1.5 ft) divided by the scale of 17.3, which is 0.0867 ft. [.] Discuss what purpose the boundary layer calculation serves. Discuss whether the entry length should be found to determine where in the pipe the flow becomes turbulent.

29. In Section 4.3.2 (4), the MSIV internals were modeled and included in the overall scale model; however, the TCV internals were not. Address why were they not modeled. Confirm whether and how the main steam line flow restrictor is included in the model.

30. a) Address how the steam colliding with the long radius elbows does not create additional noise in the pipes, which increases the frequency towards resonance, where straight pipes would not. Discuss at what minimum angle can noise generated from steam colliding with the pipe walls be neglected.

    b) Considering pipe bends create non-fully developed flow, provide the basis for assuming that the flow is fully developed throughout the entire model. While this effect can be neglected if the pipe length is much larger than the pipe bend radius, provide the minimum pipe radius for this assumption.

31. Section 7.1 - Table 11 of the SMT Report shows the RMS and peak pressures for the SMT prediction and the plant measurement in the 150-162 Hz band. If sensors P1, P2,

and P3 are on one side of the steam dryer and sensors P9, P10, and P11 are in a similar location on the other side of the dryer, discuss why the trends in Table 11 are not similar for the groups. Discuss why there are not similar pressure trends for sensors in symmetric locations.

32. Discuss the potential effects on the S/RVs from possible resonant frequencies that could occur, leading to valve failures. Effects due to vortex shedding were examined for the steam dryer; discuss whether this anomaly would exist in the valves.

33. Regarding uncertainty analysis, discuss whether the uncertainties in the venturi calculation from the manufacturer taken into account (accuracy, resolution, and propagated errors). For the exponential pressure/velocity relationship, discuss the basis for the exponent [________].

34. The SMT Report indicates that the SMT [____]. In some cases, the SMT data trended in the opposite direction from the QC2 plant data. See Table 11 (75 percent underprediction from 150-162 Hz) and Figures 75 to 98, 109, 112, 117, and 120. Discuss the basis for reliance on the SMT in predicting steam dryer loading in Browns Ferry Nuclear Plant (BFN) in light of these [____________________].

35. On page 175, the SMT Report states that the SMT amplitude measurements associated with S/RV resonances [____]. Discuss the reliability of this effort based on the significant underprediction of the QC2 plant data by the SMT and the nonlinearity of the data.

36. On page 175 of the SMT Report, the vendor recommends power ascension monitoring in light of the error in the SMT load prediction. Discuss the plans to address this recommendation.

37. Page 19 of the SMT Report states that additional work is on-going to improve the accuracy of the load predictions. Discuss the status and success of this additional work.

38. In reference to Table 3-6 and Section 3.3.4, Reactors Internal Structural Evaluation of the PUSAR, the reactor internal components such as shroud, shroud support, core plate, top guide, orificed fuel support, fuel channel, jet pump, core spray line and sparger, incore housing and guide tube, vessel head cooling spray nozzle, jet pump instrument penetration, core differential pressure and standby liquid control line and CRD were evaluated qualitatively for the EPU condition. Provide a quantitative evaluation by comparing the key parameters and design transients, loads and load combinations that are used in the design basis analysis report for stresses and cumulative usage factors in each component, against the EAU condition. Confirm whether and how the design basis parameters envelop those of the EAU condition.

39. Section 3.3.5, Flow Induced Vibration, of the PUSAR, states that analyses performed to evaluate the effects of FIV on the reactor internals at EAU conditions were based on vibration data obtained during startup testing of a prototype plant (Browns Ferry Unit 1) or of similar boiling water reactor (BWR) plants. The expected vibration levels for EAU were estimated by extrapolating the vibration data recorded in the prototype plant or

similar plants and on GE BWR operating experience. These expected vibration levels were then compared with the established vibration acceptance limits. For the proposed EAU operation at BFN Units 2 and 3, the components in the upper zone of the reactor, such as the moisture separators and dryer, are mostly affected by the increased steam flow. The adverse effects of increased steam flow on the steam dryer is evaluated in a separate analysis. Provide a summary of the quantitative evaluation for the effects of flow induced vibration on steam separators for the proposed EAU condition at Units 2 and 3.

40. Section 3.5, Reactor Coolant Pressure Boundary (RCPB) Piping, of the PUSAR indicates that the effects of the EAU have been evaluated for the RCPB piping systems and their supports. Other than the main steam (MS) and Feedwater system, the RCPB piping systems are not significantly affected by the proposed constant operating pressure power uprate (CPPU) at Units 2 and 3. Provide the maximum calculated stress and fatigue usage factors at the current rated and the CPPU conditions in comparison with the Code allowable limits for the feedwater piping and the main steam and the branch piping connected to the MS headers.

41. Section 3.5 of the PUSAR states that the supporting structure for the MS piping system is currently being evaluated for increased loading associated with the limiting transient at EAU conditions. Any supporting structure modifications deemed necessary due to EAU increased transient loads will be completed prior to EAU implementation. Provide the results of the evaluation and identify the supports that are added or modified for the proposed power uprate condition for the RCPB piping systems.

42. In Section 3.4 of the PUSAR states that the reactor recirculation system (RRS) components (e.g., pumps and valves) will be evaluated at EAU conditions to ensure that safety and design objectives are met. Provide a summary of the evaluation for the reactor recirculation pumps and valves at the EAU condition. Discuss the effects of EAU on vibration due to the vane-passing frequency of the RRS pump to accommodate the increase in thermal power. Confirm whether a modification is required for the RRS piping and supports after the EAU and identify the modification if any.

43. Section 3.11, Balance-of-Plant Piping (BOP) Evaluation, of the PUSAR indicates that for EAU conditions, the loss-of-coolant accident (LOCA) torus shell response loads were reevaluated using a more realistic reactor pressure vessel (RPV) depressurization to within the capability of the available number of main steam relief valves. These loads were found to be acceptable and there are no adverse effects on the torus shell attached structures. Discuss the EAU LOCA loads using the more realistic RPV depressurization in comparison with the LOCA loads originally defined for Units 2 and 3.

44. Section 3.11of the PUSAR indicates that, for those BOP piping analyzed, the maximum stress levels and fatigue analysis results were reviewed for the increases in temperature, pressure and flow rate. Provide the maximum calculated stresses and fatigue usage factors for the evaluated BOP piping systems, including those attached to the torus shell.

45. Section 3.11 and Table 3-7c of the PUSAR indicates that no results were provided associated with the percentage increase in the MS piping stress because the TSV

transient was not considered previously for Browns Ferry. Provide the maximum stresses and fatigue usage factors resulting from the EAU evaluation for the BOP main steam piping outside the containment in comparison with the code allowable limits. Confirm whether any modifications are required for the BOP piping and supports following the EAU at BFN. Identify these modifications if any.

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BROWNS FERRY NUCLEAR PLANT

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