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

May 12, 2015

Mr. Joseph W. Shea
Corporate 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 FOR TECHNICAL SPECIFICATION CHANGES TO REACTOR CORE SAFETY LIMITS (TAC NOS. MF5412, MF5413, AND MF5414)

Dear Mr. Shea:

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated December 11, 2014, Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request for review and approval of a revision to the Browns Ferry Nuclear Plant, Units 1, 2, and 3, Technical Specification (TS) Section 2.1.1, to reflect a lower reactor steam dome pressure for Reactor Core Safety Limits 2.1.1.1 and 2.1.1.2. TVA states that the revision is needed to address the potential to exceed the low pressure TS safety limit.

The NRC staff reviewed the licensee's submittals and determined that additional information is needed. On April 20, 2015, the NRC staff forwarded, by electronic mail, a draft of the staff's request for additional information (RAI) to TVA. On April 30, 2015, the NRC staff and TVA staff held a conference call to provide the licensee an opportunity to clarify any portion of the draft probabilistic risk assessment (PRA) RAI and discuss the timeframe for which TVA may provide the requested information. The finalized PRA questions are found in the enclosed RAI. This request was discussed with Mr. Gordon Williams of your staff, and it was agreed that TVA would respond by June 5, 2015.

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 RELATED TO

TECHNICAL SPECIFICATION CHANGES TO REACTOR CORE SAFETY LIMITS

TENNESSEE VALLEY AUTHORITY

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

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

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated December 11, 2014 (Agencywide Documents Access and Management System Accession No. ML14363A158), Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request (LAR) for review and approval of a revision to the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, Technical Specification (TS) Section 2.1.1, to reflect a lower reactor steam dome pressure for Reactor Core Safety Limits 2.1.1.1 and 2.1.1.2. TVA states that the revision is needed to address the potential to exceed the low pressure TS safety limit. The NRC staff has reviewed the request submitted by the licensee and determined that the following additional information is needed.

Request for Additional Information (RAI)-01

The LAR claims the GE14 fuel in BFN, Unit 1, is third cycle fuel, with large minimum critical power ratio (MCPR) margins due to the depleted state of the fuel and the lower power locations of those bundles. Provide the normalized bundle power (ratio of bundle power to core-averaged bundle power) at the beginning of the current cycle for the (1) GE14 fuel with the highest bundle power and (2) highest powered bundle in the core.

RAI-02

AREVA Report ANP-3245P, Revision 1 (Attachment 5 to the LAR) presented an analysis of the pressure regulator failure open (PRFO) event in the BFN units. The analysis included sensitivity studies of the effect of key parameters that affect the minimum reactor steam dome pressure obtained during the PRFO event. The lowest steam dome pressure while the reactor power is still above 25 percent rated thermal power (RTP) is the relevant pressure to use in applying TS Safety Limits 2.1.1.1 and 2.1.1.2.

a) For the PRFO event represented in Tables 3.1 through 3.6 of ANP-3245P, Revision 1, clarify the occurrence of the minimum steam dome pressure with respect to the full closure of the main steam isolation valve (MSIV). Indicate the status of the MSIV, partially or fully closed, when the minimum steam dome pressure occurred.

b) Table 3.7 of ANP-3245P, Revision 1, shows the minimum steam dome pressure for different initial state points (reactor power and core flow). Each row in the table

is for a different combination of state points. Clarify the distinction between the pressures in the table with and without an asterisk. For the higher core flow cases (above 35 percent of rated core flow), indicate if the reactor thermal power is above or below 25 percent RTP when the minimum steam dome pressure occurred.

RAI-03

TS 2.1.1.2 specifies the safety limit on the MCPR. The proposed change in TS 2.1.1.2 expands the range of applicability of the safety limit on the MCPR to a lower pressure. The LAR requires extending the applicability of the SPCB/GE14 critical power correlation down to pressures as low as 585 pounds per square inch gauge (psig). Explain the consistency of the approach discussed in ANP-3245P, Revision 1 (Attachment 5 to the LAR), for determining the critical power for GE14 fuel at pressures below 685 psig, with the NRC-approved AREVA methodology for applying AREVA critical power correlations to co-resident fuel (as identified in the Core Operating Limits Report).

RAI-04

In a PRFO event, the core inlet subcooling will decrease as the water saturation temperature decreases in response to the declining system pressure. Figure 4.1 of ANP-3245P, Revision 1, shows that a lower inlet subcooling will reduce the critical heat flux. The SPCB critical power correlation also predicts a lower critical power for a lower inlet subcooling, as indicated in Figures 2.8 and 2.9 of the AREVA Topical Report EMF-2209(p), Revision 3 (SPCB Critical Power Correlation, December 2009). The last paragraph on page 4-2 of ANP-3245P, Revision 1 (Attachment 5 to the LAR) states:

> For pressures that are lower than the SPCB/GE14 700 psia [pounds per square inch absolute] correlation boundary, the critical power will be evaluated as though the pressure was at 700 psia (preserving the same inlet subcooling). The results of applying the SPCB/GE14 correlation to pressures lower than 700 psia is illustrated with dashed lines in Figure 4.5 and indicates that the alternative low pressure boundary treatment is conservative.

a) Explain how the varying inlet subcooling condition during a PRFO transient is accounted for in the application of the SPCB/GE14 correlation for pressures below 700 psia.

b) Explain in more detail the meaning of "preserving the same inlet subcooling." Does it mean the actual inlet subcooling will be used (accounting for the effect of lower pressure) but the dome pressure will be assumed to stay at 700 psia?

RAI-05

ANP-3245P, Revision 1 (Attachment 5 to the LAR) provides results for a series of sensitivity calculations in Tables 3.1 through 3.7. However, the initial conditions are not stated for each series. For each series (i.e., Tables 3.1 through 3.7), provide the initial conditions for cycle exposure, core power, core flow, steam dome pressure, feedwater temperature, MSIV closure time, scram insertion speed, and core average gap conductance.

RAI-06

Explain why the pressures in Tables 3.4 and 3.6 of ANP-3245P, Revision 1 (Attachment 5 to the LAR) are significantly lower than values in Tables 3.1, 3.2, 3.3, and 3.5.

RAI-07

Section 3.1.6 of ANP-3245P, Revision 1 (Attachment 5 to the LAR) discusses the sensitivity of the minimum steam dome pressure to the core average gap conductance (HGAP). Under steady-state conditions for a given power, the average fuel temperature will vary inversely with the HGAP, while the fuel cladding surface temperatures will not be affected. Thus, the amount of heat transferred from the fuel to the coolant remains the same under steady-state conditions regardless of the value of the HGAP. A statement in the first paragraph of Section 3.1.6 says, "A higher core average HGAP, assuming all other parameters are held constant, will result in more heat being transferred into the coolant."

a) Explain if the statement is referring to steady-state or transient conditions and provide results from the analysis to substantiate the claim that a higher HGAP will result in more heat being transferred into the coolant.

b) Explain the impact of the HGAP on the timing of the turbine header pressure reaching the low-pressure isolation setpoint.

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
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