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, as supplemented by letters dated November 13, December 15 (two letters), 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 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 level of 3,458 MWt.

In addition, by letter dated February 29, 2016, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI). The licensee, by letter dated March 9, 2016, responded to the requested information.

The NRC staff reviewed the licensee's submittals and determined that a followup RAI is needed. On June 27, 2016, the NRC staff forwarded, by electronic mail, a draft of the staff's followup RAI to TVA. On June 30, 2016, TVA informed the NRC staff, by 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 July 31, 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 (two 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 level of 3,458 MWt.

In addition, by letter dated February 29, 2016 (ADAMS Accession No. ML16049A643), the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI). The licensee, by letter dated March 9, 2016 (ADAMS Accession No. ML16070A189), responded to the requested information.

The NRC staff from the Radiation Protection and Consequence Branch (ARCB), Division of Risk Assessment, Office of Nuclear Reactor Regulation, reviewed the submitted LAR and the licensee's responses, and determined that the following information is needed to complete the review of dose analysis (DA) portions of TVA submittals.

ARCB-DA-RAI 1.1[1]

Regulatory Basis

The following regulations and requirements are applicable to this RAI:

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.67, "Accident source term" states that:

> (i) An individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 0.25 Sv [Sievert] (25 rem) [Roentgen equivalent man] total effective dose equivalent (TEDE);

[1] Followup RAI to ARCB-DA-RAI 1.

(ii) An individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage), would not receive a radiation dose in excess of 0.25 Sv (25 rem) total effective dose equivalent (TEDE); and,

(iii) Adequate radiation protection is provided to permit access to and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) total effective dose equivalent (TEDE) for the duration of the accident.

Appendix A to 10 CFR Part 50, "General Design Criteria (GDC)," Criterion 19--Control room, in part, states:

A control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem [0.05 Sv] whole body, or its equivalent to any part of the body, for the duration of the accident...

Applicants for and holders of construction permits and operating licenses under this part who apply on or after January 10, 1997, applicants for design approvals or certifications under part 52 of this chapter who apply on or after January 10, 1997, applicants for and holders of combined licenses or manufacturing licenses under part 52 of this chapter who do not reference a standard design approval or certification, or holders of operating licenses using an alternative source term under § 50.67, shall meet the requirements of this criterion, except that with regard to control room access and occupancy, adequate radiation protection shall be provided to ensure that radiation exposures shall not exceed 0.05 Sv (5 rem) total effective dose equivalent (TEDE) as defined in § 50.2 for the duration of the accident.

Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Revision 0, July 2000 provides the methodology for analyzing the radiological consequences of several design basis accidents to show compliance with 10 CFR 50.67. RG 1.183 provides guidance to licensees on acceptable application of alternate source term (AST) submittals, including acceptable radiological analysis assumptions for use in conjunction with the accepted AST. It also states that the amendment request should describe the licensee's analyses of the radiological and non-radiological impacts of the proposed in sufficient detail to support review by the NRC staff.

Background:

In Enclosure 2 of the letter dated August 30, 2013 (ADAMS Accession No. ML13268A421), TVA stated:

> Consistent with NRC guidance for resolving non-conforming/degraded conditions, final corrective actions for this condition will involve modification of the facility or licensing basis other than restoration to the conditions as described in the licensing submittals. The corrective actions to be taken are as follows.
>
> 1. The BFN will use the ALT [Alternate Leakage Treatment] secondary flow path as the ALT primary flow path.
>
> 2. The total allowable MSIV [Main Steam Isolation Valve] leakage rate will be decreased from current Technical Specification value of 150 standard cubic feet per hour to a value that supports meeting dose requirements in association with action item 1.
>
> 3. A revised dose analysis will be performed which includes the changes made to the application of ALT described in items 1 and 2, above.
>
> 4. A License Amendment Request will be submitted which reflects the changes made to the application of ALT at BFN.

Further, TVA, in Enclosure 4 of the August 30, 2013, letter, made the following commitment: "By November 21, 2013, TVA will submit a License Amendment Request to resolve the non-conforming/degraded conditions related to the alternate leakage path issue."

On November 22, 2013, TVA submitted a LAR (ADAMS Accession No. ML14015A403) to revise the leakage rate criteria through MSIVs and make the current passive secondary ALT Pathway be the primary pathway. As a result of discussions on a draft RAI[2] in a closed meeting on March 18, 2015, TVA withdrew its submitted LAR on May 29, 2015 (ADAMS Accession No. ML15159B009). TVA, in its withdrawal letter, committed: (1) revise the reply to the Notice of Violation to detail the facility modifications such that the licensing basis dose calculations would remain valid and include a schedule for when the plant will be in conformance with its licensing basis, and (2) provide an annual status letter to update the NRC on progress of facility modifications until all modifications are complete.

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[2] Official RAI to the licensee was issued on April 8, 2015 (ADAMS Accession No. ML15091A684)

In a letter dated July 15, 2015 (ADAMS Accession No. ML15198A353), TVA stated that the existing compensatory measures are as follows:

1. BFN is using the ALT secondary flow path as the ALT primary flow path.

2. The total allowable MSIV leakage rate has been decreased from the current Technical Specification value of 150 standard cubic feet per hour (scfh) to the 85 scfh value that support meeting dose requirements in association with action item 1.

3. A revised dose analysis was performed that includes the changes made to the application of ALT described in items 1 and 2, above.

Request for Additional Information

In Section 2.9.2, "Radiological Consequences Analyses Using Alternative Source Terms," of Attachments 6 and 7,[3] "Safety Analysis Report for Browns Ferry Nuclear Plant Units,1, 2, and 3 Extended Power Uprate," of the extended power uprate (EPU) LAR dated September 21, 2015, TVA stated, in part, that the effect of the proposed EPU on the radiological consequences of the loss-of-coolant accident (LOCA), fuel handling accident, control rod drop accident, and the main steamline break accident is based on an assessment of the effect of EPU changes on the dose consequence analyses that were evaluated by the NRC in the safety evaluation for the Browns Ferry AST License Amendments 251, 290, and 249, which approved a full-scope implementation of an AST that complies with the guidance given in RG 1.183 and 10 CFR 50.67.

By letter dated March 9, 2016 (ADAMS Accession No. ML16070A189), TVA responded to the RAIs associated with dose analysis. Specifically, the staff in ARCB-DA-RAI 1 asked that the licensee provide the current licensing basis (CLB) and the revised EPU input values, assumptions, and methods, as well as a justification for any changes to the CLB. The NRC also requested that the licensee identify which of these parameters were not previously reviewed and approved by the NRC and provide a justification for the change from the previously reviewed values to the CLB. TVA, in its response dated March 9, 2016, supplemented the above information with additional information regarding updates to the LOCA analyses. TVA, in the RAI response, stated, in part, that "The LOCA analysis was subsequently [after approval of the AST] revised and approved in the license amendments issued for Technical Specification (TS) Change Request TS-474 [Amendment Nos. 282, 308, and 267 for Units 1, 2 and 3, respectively]."

In the RAI response TVA did not discuss information regarding a non-conforming/degraded condition that impacts the design configuration and accident response reviewed and approved in the Amendment Nos. 251/282 (Unit 1), 290/308 (Unit 2) and 249/267 (Unit 3). However, in a letter dated May 26, 2016 (ADAMS Accession No. ML16148A108), TVA stated that it is expected to resolve the non-conforming/degraded condition during Refueling Outage 18 in fall 2018 (Unit 1), Refueling Outage 20 in spring 2019 (Unit 2), and Refueling Outage 18 in spring 2018 (Unit 3).

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[3] Attachment 7 (ADAMS Accession No. ML15282A181) contains the public version of Attachment 6.

TVA proposes to use the approval of Amendments 251/282 (Unit 1), 290/308 (Unit 2) and 249/267 (Unit 3) to justify the dose analysis at the EPU condition, but the design configuration and accident response assumed in these amendments does not exist due to a non-conforming/degraded condition. In order to determine that there is "reasonable assurance" that the acceptance criteria for the radiological consequences analyses for 10 CFR 50.67 and GDC 19 are met, the NRC staff asks TVA to provide either:

1. A license condition to "perform facility and licensing basis modifications such that the current licensing basis dose calculations would remain valid"[4] prior to the implementation of the EPU,

   Or

2. Provide the following information.

   a. Since the withdrawal of the LAR on May 29, 2015, what changes were made to the compensatory measures (including the dose analysis submitted to the NRC) to address the NRC's concerns with the LAR (as discussed in the March 18, 2015 meeting)?

   b. Explain how the compensatory measures, discussed above, restored all applicable structures systems and components to operability/functionality such that they can perform their desired safety function.

   c. With a non-conforming/degraded condition in the primary ALT flow path (that may not function during a LOCA due to valve(s) closing that may not be reopened) and considering a single failure in the secondary ALT flow path how are the safety functions of these ALT flow paths ensured?

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[4] This wording is taken directly from a letter from TVA to the NRC dated May 26, 2016, providing the latest update on progress to resolve the non-conforming/degraded condition. These modifications would make the design configuration and accident response consistent with those assumed in Amendment Nos. 251/282 (Unit 1), 290/308 (Unit 2) and 249/267 (Unit 3), the calculations valid, and therefore, the previous finding of "reasonable protection" would be valid.

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

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

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