Proprietary Information Withhold Under 10 CFR 2.390(a)(4)
This letter is decontrolled when separated from Enclosure 1

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

CNL-15-195

October 23, 2015

10 CFR 50.90

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

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Response to NRC Request for Additional Information on the Proposed License Amendment Request to Modify Browns Ferry Nuclear Plant, Unit 3 P/T Limits (BFN TS-494) (TAC No. MF5659)**

References:

1. Letter from TVA to NRC, CNL-14-144, "Browns Ferry Nuclear Plant, Unit 3 - Application to Modify Technical Specification 3.4.9, 'RCS Pressure and Temperature (P/T) Limits' (BFN TS-494)," dated January 27, 2015 (ML15040A698)
2. Letter from TVA to NRC, CNL-15-124, "Response to NRC Request for Additional Information on the Proposed License Amendment Request to Modify Browns Ferry Nuclear Plant, Unit 3 P/T Limits (BFN TS-494) (TAC No. MF5659)," dated August 13, 2015 (ML15226A324)
3. Electronic Mail from NRC to TVA, "RAI for BFN Unit 3 Regarding Request to Modify Technical Specification 3.4.9 RCS Pressure and Temperature (P/T) Limits (MF5659)," dated September 21, 2015 (ML15265A274)

By letter dated January 27, 2015 (Reference 1), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) to revise the Browns Ferry Nuclear Plant, Unit 3, Technical Specifications (TS) for Limiting Condition for Operation (LCO) 3.4.9, "RCS Pressure and Temperature (P/T) Limits."

By letter dated August 13, 2015 (Reference 2), TVA responded to an NRC request for additional information (RAI) to support the review of the LAR. By electronic mail dated September 21, 2015, NRC transmitted an additional RAI. The due date for the response is October 23, 2015. Enclosure 1 to this letter contains the GE Hitachi Nuclear Energy (GEH) report that provides the response to the Reference 3 RAI. Enclosure 1 contains information that GEH considers to be proprietary in nature and subsequently, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4), it is requested that such information be withheld from public disclosure. Enclosure 2 contains the non-proprietary version of the Enclosure 1 report with the proprietary material removed, and is suitable for public disclosure. Enclosure 3 provides the affidavit supporting this request.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations*, Part 50.92(c), TVA has determined that the additional information, as provided in this letter, does not affect the no significant hazards consideration associated with the proposed application previously provided in Reference 1.

There are no new regulatory commitments contained in this submittal. Please address any questions regarding this submittal to Mr. Edward D. Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 23rd day of October 2015.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. DOC-0005-4311-1 GEH Response to RAI SRXB–RAI 5 (Proprietary)
2. DOC-0005-4311-1 GEH Response to RAI SRXB–RAI 5 (Non-Proprietary)
3. Affidavit for Enclosure 1

cc (Enclosure):
NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Browns Ferry Nuclear Plant
State Health Officer, Alabama State Department of Health

Tennessee Valley Authority

Enclosure 1

Response to NRC Request for Additional Information on the Proposed License Amendment Request to Modify Browns Ferry Nuclear Plant, Unit 3 P/T Limits

DOC-0005-4311-1 GEH Response to RAI SRXB–RAI 5 (Proprietary)

Tennessee Valley Authority

Enclosure 2

Response to NRC Request for Additional Information on the Proposed License Amendment Request to Modify Browns Ferry Nuclear Plant, Unit 3 P/T Limits

DOC-0005-4311-1 GEH Response to RAI SRXB–RAI 5 (Non-Proprietary)

ENCLOSURE 2

DOC-0005-4311-1

GEH Response to RAI SRXB–RAI 5

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of DOC-0005-4311-1, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

SRXB – RAI 5

The NRC staff reviewed the neutron fluence calculations and uncertainty analysis performed using GE Licensing Topical Report NEDO-32983P-A, Revision 2, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 2006, (ML072480121). It is not clear that when the neutron fluence method in NEDO-32983P-A, Revision 2, was approved, that it included detailed consideration of important phenomena associated with neutron fluence calculations outside the beltline region of the reactor pressure vessel. Recent NRC staff experience with license renewal applications has shown that the neutron fluence uncertainties for the upper regions of the reactor pressure vessel are highly sensitive to the assumed above core void fraction distribution and can lead to high uncertainties in these regions. Furthermore, it was seen that components located outside of the beltline and exceeding a neutron fluence of $1x10^{17}$ n/cm^2 could become limiting based on estimated uncertainties; refer to discussions in the documents at ADAMS Numbers ML15036A564 and ML1528A552 for additional background information.

Enclosure 3 of the application, NEDO-33857, "Pressure and Temperature Limits (PTLR) Up to 38 and 54 Effective Full Power Years", contains two tables for BFN3 Adjusted Reference Temperatures for 38 and 54 EFPY. Table B-4, BFNP Unit 3 Adjusted Reference Temperature for up to 38 EFPY, states that the nozzles forging ¼ T fluence is $3.19x10^{17}$ n/cm^2. Table B-5, BFNP Unit 3 Adjusted Reference Temperature for up to 54 EFPY, states that the nozzles forging ¼ T fluence is $4.67x10^{17}$ n/cm^2.

If comparisons to benchmark data (i.e., calculated-to-measured dosimetry activities) exists supporting the validation of neutron fluence calculations outside of the beltline and above the core, the NRC staff requests that these comparisons be provided.

Alternatively, the NRC staff requests that the licensee provide additional information on the plant-specific sensitivity analyses performed for BFN3. Specifically, show how the variability in above core water density is treated as part of the analytic uncertainty analysis used to estimate the potential variability in fluence calculations. Include the nominal above core water density assumed and its potential variation; also, provide the bases for these assumptions. If adjustments to calculated neutron fluence values are shown to be necessary, indicate whether the proposed P/T curves would be affected, and if so modify them accordingly.

GEH Response

The effects of variations in water density in regions above the core to the Reactor Pressure Vessel (RPV) fluence as it impacts Pressure-Temperature (P/T) limits are appropriately addressed by conservatisms in the fluence analysis, supported by comparison to best-estimate thermal hydraulic analysis at bounding operating conditions. Therefore, the fluence basis used in the P/T curves is adequate and does not need adjustments.

Regions within the Beltline

The Browns Ferry Unit 3 Water Level Instrumentation (WLI) nozzle is included in the adjusted reference temperature calculations as the fluence is greater than $1x10^{17}$ n/cm^2 and it is within the core beltline region as shown by Table B-7 of NEDC-33857P (Reference 1). The fluence at the RPV inner diameter at the elevation of the WLI nozzle is calculated using the method described in GE licensing topical report NEDC-32983P-A, Revision 2 (Reference 2). The ¼-thickness fluence is determined using the formula given in Regulatory Guide 1.99. Therefore, the uncertainty associated with the fluence calculation determined in NEDC-32983P-A, Revision 2 is applicable to the WLI nozzle.

Regions above the Beltline

In regards to the regions outside the beltline, the fluence analysis used [[ ]] in the region above the core (also known as the upper plenum). This water density is compared to the results for Browns Ferry from the GEH best-estimate thermal hydraulic code, TRACG, in Table 1. TRACG is a GEH proprietary version of the Nuclear Regulatory Commission's Transient Reactor Analysis Code (TRAC). TRACG uses advanced best-estimate one-dimensional and three-dimensional methods to model the phenomena that are important in evaluating the operation of Boiling Water Reactors (BWRs). Best-estimate analyses performed with TRACG have been approved by the NRC to support licensing applications in different areas, including thermal-hydraulic instability in NEDE-33147P-A, Revision 4 (Reference 3), and anticipated operational occurrence transients in NEDE-32906P-A, Revision 3 (Reference 4).

Table 1: Water Density Distribution in the Upper Plenum from TRACG Analysis at Nominal EPU/MELLLA+ Conditions for Browns Ferry

Level ID	Axial Level	Water Density (g/cm^3) Above the Core				% Difference[1]
		Ring 1 Inner	Ring 2 Intermediate	Ring 3 Peripheral	Volume Averaged	
12	Below the Separator	[[				
11	Above the Core					]]

[1] [[ ]]

Table 1 shows the water density distribution in the upper plenum, separated into rings for regions above the core. As shown in Table 1, the regions towards the center of the core have a lower water density and the region in the core periphery has a higher water density due to higher power bundles in the central region of the core causing a higher void fraction. Axially, Level 11 is located below Level 12. The region at Level 11 is above the core. As the flow travels upwards, mixing amongst the rings results in a more homogenous water density distribution.

Table 1 values are from an end of cycle statepoint at an uprated power of 120% of original licensed thermal power and 85% of rated flow. This corresponds to the most limiting statepoint since high power and low flow results in a higher void fraction and a lower water density in the region above the core. BWRs do not typically operate at the lowest permissible flow for the entire cycle since they typically use flow to control reactivity, increasing flow to compensate for the burnup of fuel for a certain control blade pattern sequence during the cycle. Therefore, the core flow varies between the minimum and maximum permissible flow throughout the cycle. The water density used in the fluence analysis is more conservative than the most bounding power/flow statepoint (i.e., snapshot in time) water density in the upper plenum. The impact of this conservatism is integrated over the entire operating period.

The ability of a neutron to travel from the source (fuel) to the component of interest (RPV) is highly dependent on the geometry and material within its path. A neutron must traverse the high density material within the core, the no void coolant in the bypass, the shroud, the high density water in the downcomer, and the jet pumps, before reaching the RPV. From transport theory, it is known that regions closer to the RPV (i.e., the detector or flux location of interest) have higher importance as the relative contribution to the flux is greater. The variation in water density associated with the most important region (the downcomer) is already characterized and taken into account in the determination of the overall uncertainty as described in NEDC-32983P-A, Revision 2 (Reference 2). Furthermore, the water density in the peripheral ring, the region with the highest importance amongst the regions in the upper plenum, has the highest water density, at least [[ ]] higher than the density used in the fluence analysis. The volume averaged water density at either level is bounded by the water density used in the fluence analysis.

Fundamental knowledge of particle transport supports that the actual neutron fluence to the RPV decreases as the axial distance from the beltline (location of the source) to the location of interest (in this case the regions above the beltline) increases. Although the analytical uncertainty is not specifically quantified, the following analysis decisions conservatively account for water density variation in the fluence:

- Thermal hydraulic analysis results chosen for comparison are from the most limiting statepoint (120% of original licensed thermal power and 85% of rated flow). The impact of the conservatism in water density is integrated over the entire operating period.
- The water density in the fluence analysis bounds the region of highest importance amongst the rings in the upper plenum (peripheral ring).
- The water density in the fluence analysis bounds the volume averaged water density from the best-estimate thermal hydraulic analysis.

Therefore, the fluence basis used in the P/T curves is adequate and does not need adjustments.

References

1. GE Hitachi Nuclear Energy, "Tennessee Valley Authority Browns Ferry Nuclear Plant Unit 3 Pressure and Temperature Limits Report Up to 38 and 54 Effective Full-Power Years," NEDC-33857P, Revision 0, May 2014.
2. GE Nuclear Energy, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," NEDC-32983P-A, Revision 2, January 2006.
3. GE Hitachi Nuclear Energy, "DSS-CD TRACG Application," NEDE-33147P-A, Revision 4, August 2013.
4. GE Nuclear Energy, "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses," NEDE-32906P-A, Revision 3, September 2006.

Tennessee Valley Authority

Enclosure 3

Response to NRC Request for Additional Information on the Proposed License Amendment Request to Modify Browns Ferry Nuclear Plant, Unit 3 P/T Limits

Affidavit for Enclosure 1

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Lisa K. Schichlein, state as follows:

(1) I am a Senior Project Manager, NPP/Services Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter DOC-0005-4311-1, "GEH Response to Browns Ferry Unit 3 PTLR RAI SRXB-RAI 5," dated October 15, 2015. The GEH proprietary information in Enclosure 1, which is entitled "GEH Response to RAI SRXB–RAI 5," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. Sec. 552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH,

and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary or confidentiality agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains the detailed GEH methodology for pressure-temperature curve analysis for the GEH Boiling Water Reactor (BWR). These methods, techniques, and data along with their application to the design, modification, and analyses associated with the pressure-temperature curves were achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their

own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 15th day of October 2015.

Lisa K. Schichlein
Senior Project Manager, NPP/Services Licensing
Regulatory Affairs
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