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-15-124

August 13, 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, "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 (ADAMS Accession No. ML15040A698)
2. Electronic Mail from NRC to TVA, "RAIs for Browns Ferry Unit 3 P/T curves LAR," dated July 6, 2015 (ADAMS Accession No. ML15189A244)

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 electronic mail dated July 6, 2015 (Reference 2), the Nuclear Regulatory Commission (NRC) transmitted a request for additional information (RAI) to support the review of the LAR. The due date for the response is August 14, 2015. Enclosure 1 to this letter contains a GE Hitachi Nuclear Energy (GEH) report which provides the responses to RAIs 1 and 2 of Reference 2. Enclosure 1 contains information that GEH considers to be proprietary in nature and subsequently, pursuant to 10 *Code of Federal Regulations* 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. Enclosure 4 provides TVA's response to RAI 3 of Reference 2.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR), 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 13th day of August 2015.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. DOC-0004-9945 2 GEH Responses to RAIs SRXB–RAI 1 and SRXB–RAI 2 (Proprietary)
2. DOC-0004-9945 2 GEH Responses to RAIs SRXB–RAI 1 and SRXB–RAI 2 (Non-Proprietary)
3. Affidavit for Enclosure 1
4. Response to NRC SRXB–RAI 3 on the Proposed License Amendment Request for Browns Ferry Nuclear Plant, Unit 3 (TAC No. MF5659)

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 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-0004-9945 2 GEH Responses to RAIs SRXB–RAI 1 and SRXB–RAI 2
(Non-Proprietary)

ENCLOSURE 2

DOC-0004-9945 2

GEH Responses to RAIs SRXB–RAI 1 and SRXB–RAI 2

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of DOC-0004-9945 2, 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 1

BAW-1845, "Browns Ferry Core Region Materials Information (Units 1, 2, and 3)," dated August 1984, provides information on the materials and fabrication information for the Browns Ferry reactor vessel core region components. Figure 2-3, Browns Ferry 3 RV Fabrication Information Shell Course No.1 and Shell Course No. 2, describes axial welds locations and fabrication. There are 6 axial welds within the region of the fuel. The Pressure-Temperature Limits Report (PTLR) provides the Peak inner diameter (I.D.) and Peak 1/4 thickness (1/4T) neutron fluence values for the axial and circumferential welds. The NRC staff requests that the licensee provide the BWR neutron fluence map showing the location of the azimuthal and axial fluence variation with respect to all welds, axial welds and the circumferential weld.

GEH Response

This response provides the requested fluence information at 54 Effective Full Power Years (EFPY) of operation. The azimuthal fluence distribution for Shell Course No. 1 and 2 is shown in Figure 1-1. The azimuthal fluence in Shell Course No. 1 is evaluated at the circumferential weld, which is the location of the peak axial flux in this shell, and the fluence in Shell Course No. 2 is evaluated at the location of the overall peak axial flux. The axial fluence distribution at the axial welds in Shell Course No. 1 and 2 is shown in Figure 1-2. The circumferential weld elevation relative to the bottom of active fuel elevation is also noted in Figure 1-2.

The axial welds in Shell Course No. 1 and 2 are located at the azimuths listed in Table 1-1 and noted in Figure 1-1. Azimuths outside the first quadrant are translated to the corresponding values in the first quadrant based on the quadrant mirror symmetric loading of the fuel and core geometry. The peak fluence at each of the axial welds is listed on the figures and also in Table 1-1. Lastly, the fluence is also evaluated at the overall peak azimuth and overall peak axial flux elevation.

Table 1-1: BFN3 54 EFPY Fluence Results

Actual Azimuth (°)	Relative Azimuth (°)	Fluence (n/cm^2)
Shell Course No. 1		
20	20	1.53e18
140	40	1.22e18
260	80	8.13e17
Shell Course No. 2		
45	45	1.47e18
165	15	1.52e18
285	75	1.52e18
Peak Fluence (Over All Azimuths and at Peak Elevation)		
N/A	27.3	2.23e18

The Browns Ferry Nuclear Plant, Unit 3 (BFN3) PTLR (Reference 1-1) reports the peak fluence on vessel inner radius as 2.23e18 n/cm^2 and the value used to evaluate the axial welds is 1.52e18 n/cm^2. The small difference in the axial weld fluence between that used in the PTLR and the maximum in Table 1-1 (1.53e18 n/cm^2) has a negligible effect on the Adjusted Reference Temperature (ART) result and no effect on the Pressure-Temperature curves.

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Figure 1-1: Azimuthal Fluence Distribution

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Figure 1-2: Axial Fluence Variation

The azimuthal and axial fluence variations at the circumferential and axial weld locations are provided in Figures 1-1 and 1-2, respectively. The peak fluence at each of the axial welds and at the overall peak azimuth is listed in Table 1-1.

Reference

1-1. 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.

SRXB – RAI 2

The Browns Ferry Nuclear Plant, Unit 1 (BFN1) P/T Limits submittal (ML13358A064), dated December 18, 2013, is referenced in Section 4.2, Precedent, of the licensee's application. The NRC staff noted that the axial weld peak neutron fluence values at 38 EFPY for BFN1 when compared to the same axial welds for BFN3 at 54 EFPY peak neutron fluence values are similar. Additionally, the NRC staff approved a 5.00% power uprate for BFN3 in 1998. BFN1 returned to operating status with a 5.00% power uprate in 2007. The variance in periods of operation affects the EFPY calculated for Units 1 and 3. The NRC staff requests the following from the licensee:

a) Provide clarification regarding the calculated neutron fluence values for BFN1 and BFN3, given the different operating history for each unit;

b) Provide information for the neutron flux per fuel cycle for the peak axial weld fluence location at each unit along with the calendar dates for each unit through the period of applicability, 38 EFPY for Unit 1 and 54 EFPY for Unit 3;

c) Provide an explanation for the similarity between the 54 EFPY axial welds Peak neutron fluence values for BFN3 and the 38 EFPY axial welds Peak neutron fluence values for BFN1, including any neutron fluence calculation data to support the explanation.

GEH Response

a) The Original Licensed Thermal Power (OLTP), Current Licensed Thermal Power (CLTP), and Extended Power Uprate (EPU) power levels are consistent between BFN1 and BFN3. Furthermore, the EPU value for the peak flux on the Reactor Pressure Vessel (RPV) inner radius of 1.40e9 n/cm^{2}s is used in the fluence calculations for both BFN1 and BFN3. [[

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Table 2-1: Operational History/Projection

	Power (MWt)	Unit 1 (EFPY)	Unit 3 (EFPY)
OLTP Operations	3,293	6.14	7.42
CLTP Operations	3,458	9.04	17.51
EPU Projections[1]	3,952	22.82	29.07
Total	N/A	38	54

Note:

1. EPU operation is assumed up to the applicable total EFPY period.

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The EPU flux and operation information shown in Table 2-1 are used in the equation above to calculate the fluence values used in BFN1 and BFN3 PTLR submittals (References 2-1 and 2-2). The peak flux and fluence results are summarized in Table 2-2.

Table 2-2: BFN1 and BFN3 Fluence Results

Parameter	BFN1 38 EFPY	BFN3 54 EFPY
Peak RPV Flux(n/cm^{2}s)[1]	1.40e9	1.40e9
Peak RPV Fluence (n/cm^2)[1]	1.58e18	2.23e18
Peak Weld Fluence (n/cm^2)	N/A	1.53e18

Note:

1. Peak over all azimuths and at the peak elevation.

b) As described in the response to Part a), the flux distribution by cycle is not used in the fluence calculation. Rather, a bounding EPU flux distribution is applied in all the fluence calculations for BFN1 and BFN3. This is conservative compared to the flux at any specific location at either unit on a cycle by cycle basis. Furthermore, the equation listed in Part a) conservatively accounts for the CLTP fluence because the flux difference between EPU and CLTP is larger than the difference in power.

c) The BFN1 PTLR (Reference 2-2) analysis conservatively applied the peak vessel fluence value of 1.58e18 n/cm^2, which is the peak over all azimuths for 38 EFPY, to the axial welds rather than calculate the fluence at the specific weld locations. For the BFN3 PTLR (Reference 2-1) the fluence analysis calculated the axial weld fluence value of 1.53e18 n/cm^{2}s at the limiting axial weld location for 54 EFPY. The BFN3 peak vessel fluence is 2.23e18 n/cm^2, which is consistent with the difference expected due to the difference in applicable periods between the two units when comparing the peak fluence. The similarity between the fluence values used for the two units is due to the differences in the selection of peak or specific locations on the vessel.

References

2-1. 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.

2-2. GE Hitachi Nuclear Energy, "Tennessee Valley Authority Browns Ferry Nuclear Plant Unit 1 Pressure and Temperature Limits Report (PTLR) Up to 25 and 38 Effective Full-Power Years," NEDC-33445P, Revision 0, December 2013.

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

ENCLOSURE 3

DOC-0004-9945 2

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-0004-9945 2, "GEH Response to Browns Ferry Unit 3 PTLR RAIs SRXB-RAI 1 and SRXB-RAI 2," dated July 30, 2015. The GEH proprietary information in Enclosure 1, which is entitled "GEH Responses to RAIs SRXB–RAI 1 and SRXB–RAI 2," 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 29th day of July 2015.

Lisa K. Schichlein
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Regulatory Affairs
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Tennessee Valley Authority

Enclosure 4

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

Response to NRC SRXB–RAI 3 on the Proposed License Amendment Request for Browns Ferry Nuclear Plant, Unit 3

ENCLOSURE 4

Response to NRC RAI 3 on the Proposed License Amendment Request for Browns Ferry Nuclear Plant, Unit 3 (TAC No. MF5659)

SRXB - RAI 3

Regulatory Guide 1.190 (RG 1.190), "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," states under Section 1.2, Core Neutron Source, the following

The peripheral assemblies, which contribute the most of the vessel fluence, have strong radial power gradients, and these gradients should not be neglected. In the case of PWRs, the fuel pins closest the core periphery tend to have reduced relative power while for BWRS the peripheral fuel pins may have increased relative power. The pin-wise source distribution should be used for best-estimate calculations and the peripheral-assembly pin-wise source data should be obtained from core depletion calculations. The pin-wise source distribution should represent the absolute source distribution in the assembly.

The NRC staff requests that the licensee provide an explanation for how the neutron fluence calculation was updated to reflect the ATRIUM-10 specific fuel bundles located on the periphery.

TVA Response

AREVA has previously performed a fluence evaluation for ATRIUM-10 fuel at BFN using Blended Low Enriched Uranium (BLEU) material. The AREVA work evaluated a representative Extended Power Uprate core design utilizing a full core of ATRIUM-10/BLEU fuel. For this evaluation, the effects of burnup on the spatial distribution of the neutron source were accounted for by calculating the cycle average fission spectrum for each fissile isotope on an assembly-by-assembly basis, and by determining the cycle-average specific neutron emission rate. This data was then used with the normalized time weighted pin-by-pin relative power density (RPD) distribution to determine the spatial and energy dependent neutron source. The AREVA calculations were performed in accordance with the requirements of Regulatory Guide 1.190.

A comparison of the calculated flux values from GEH and AREVA at the limiting locations on both the shroud and reactor pressure vessel (RPV) inner surfaces showed that the ATRIUM-10/BLEU flux values are bounded by those calculated by GEH and used in the development of the BFN Unit 3 pressure-temperature limit curves. The shroud and RPV flux profiles reflect the same shape for both the GEH and AREVA calculations, but the flux values predicted by GEH are significantly higher.