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

June 2, 2015

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3D-C
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNIT 2 - ISSUANCE OF AMENDMENT REVISING PRESSURE AND TEMPERATURE LIMIT CURVES (TAC NO. MF4303)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission (NRC or the Commission) has issued the enclosed Amendment No. 314 to Renewed Facility Operating License No. DPR-52 for the Browns Ferry Nuclear Plant, Unit 2. This amendment is in response to your application dated June 19, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14175A307), as supplemented by letter dated December 2, 2014 (ADAMS Accession No. ML14336A691). The amendment revises Technical Specification (TS) 3.4.9, "RCS [Reactor Coolant System] Pressure and Temperature (P/T) Limits," page 3.4-26, and Figures 3.4.9-1 through 3.4.9-2. The new P/T limits are based on proprietary topical report NEDC-33178P-A, Revision 1, "GE [General Electric] Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves." NEDO-33178-A, Revision 1, is the non-proprietary version of this NRC-approved topical report (ADAMS Accession No. ML092370487).

The NRC staff's safety evaluation (SE) is enclosed. The NRC staff has determined that this SE does not contain sensitive information as described in Title 10 of the *Code of Federal Regulations* (10 CFR), Section 2.390, "Public inspections, exemptions, requests for withholding." However, the NRC will delay disclosing the SE to the public for a period of 10 working days from the date of this letter to provide the Tennessee Valley Authority with the opportunity to comment on any aspects of the SE that it considers to be sensitive. If you believe that any information in the enclosed SE represents sensitive information, please identify such information line-by-line and define the basis for withholding it pursuant to the criteria of 10 CFR 2.390. Otherwise, after 10 working days, the enclosed SE will be made publicly available.

The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-260

Enclosures:
1. Amendment No. 314 to License No. DPR-52
2. Safety Evaluation

cc with enclosures: Addressee only
Distribution via Listserv (10 days after issuance of the amendment to the licensee)

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-260

BROWNS FERRY NUCLEAR PLANT, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 314
Renewed License No. DPR-52

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (the licensee) dated June 19, 2014, as supplemented by a letter dated December 2, 2014, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-52 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 314 , are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Shana R. Helton

Shana R. Helton, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Operating License
and Technical Specifications

Date of Issuance: June 2, 2015

ATTACHMENT TO LICENSE AMENDMENT NO. 314

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-52

DOCKET NO. 50-260

Replace Page 3 of Renewed Facility Operating License DPR-52 with the attached Page 3.

Revise Appendix A, Technical Specifications, by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
3.4-26	3.4-26
3.4-29	3.4-29
3.4-29a	3.4-29a
3.4-29b	3.4-29b
3.4-29c	3.4-29c

sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required any byproduct, source, or special nuclear material without restriction to chemical or physical form for sample analysis or equipment and instrument calibration or associated with radioactive apparatus or components;

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, to possess but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 3458 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 314, are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

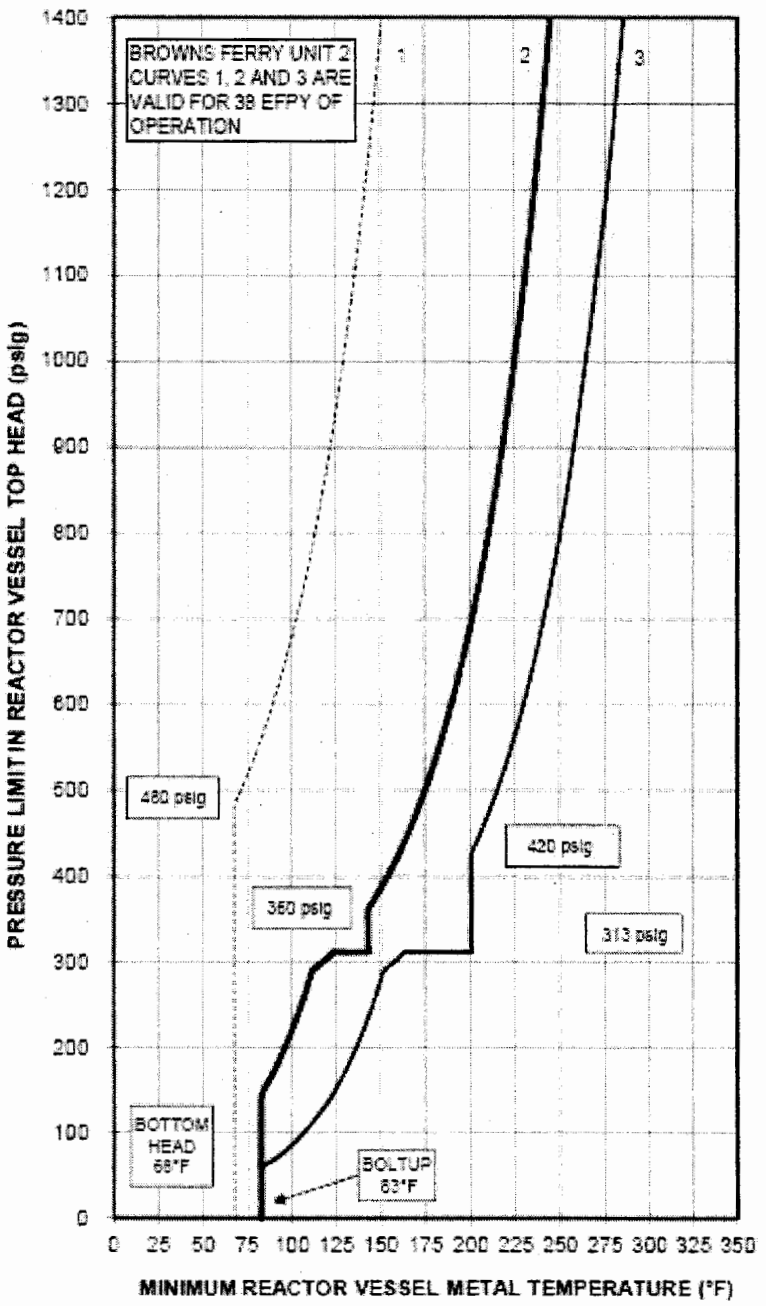
For Surveillance Requirements (SRs) that are new in Amendment 253 to Facility Operating License DPR-52, the first performance is due at the end of the first surveillance interval that begins at implementation of Amendment 253. For SRs that existed prior to Amendment 253, including SRs with modified acceptance criteria and SRs whose frequency of performance is being extended, the first performance is due at the end of the first surveillance interval that begins on the date the surveillance was last performed prior to implementation of Amendment 253.

(3) The licensee is authorized to relocate certain requirements included in Appendix A and the former Appendix B to licensee-controlled documents. Implementation of this amendment shall include the relocation of these requirements to the appropriate documents, as described in the licensee's

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.9.1	----------NOTES---------- 1. Only required to be performed during RCS heatup and cooldown operations or RCS inservice leak and hydrostatic testing when the vessel pressure is > 313 psig. 2. The limits of Figure 3.4.9-2 may be applied during nonnuclear heatup and ambient loss cooldown associated with inservice leak and hydrostatic testing provided that the heatup and cooldown rates are ≤ 15°F/hour. 3. The limits of Figures 3.4.9-1 and 3.4.9-2 do not apply when the tension from the reactor head flange bolting studs is removed. ---------- Verify: a. RCS pressure and RCS temperature are within the limits specified by Curves No. 1 and No. 2 of Figures 3.4.9-1 and 3.4.9-2; and b. RCS heatup and cooldown rates are ≤ 100°F in any 1 hour period.	30 minutes
SR 3.4.9.2	Verify RCS pressure and RCS temperature are within the criticality limits specified in Figure 3.4.9-1, Curve No. 3.	Once within 15 minutes prior to control rod withdrawal for the purpose of achieving criticality

(continued)



Curve No. 1
Minimum temperature for bottom head during mechanical heatup or cooldown following nuclear shutdown.

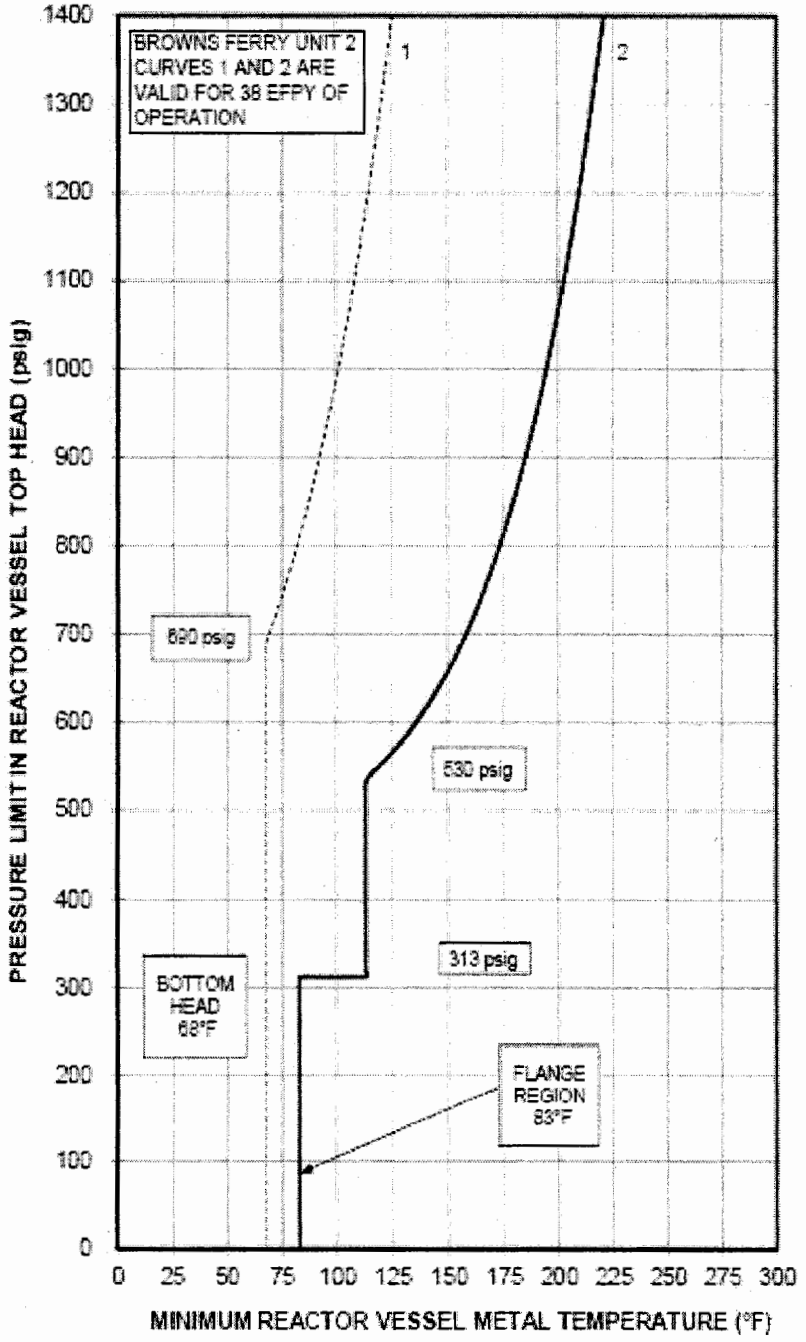
Curve No. 2
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

Curve No. 3
Minimum temperature for core operation (criticality).

Notes
These curves include sufficient margin to provide protection against feedwater nozzle degradation. The curves allow for shifts in RT_{NDT} of the Reactor vessel beltline materials, in accordance with Reg. Guide 1.99, Rev. 2, to compensate for radiation embrittlement for 38 EFPY.

The acceptable area for operation is to the right of the applicable curves.

Figure 3.4.9-1
Pressure/Temperature Limits for
Mechanical Heatup, Cooldown following Shutdown, and
Reactor Critical Operations



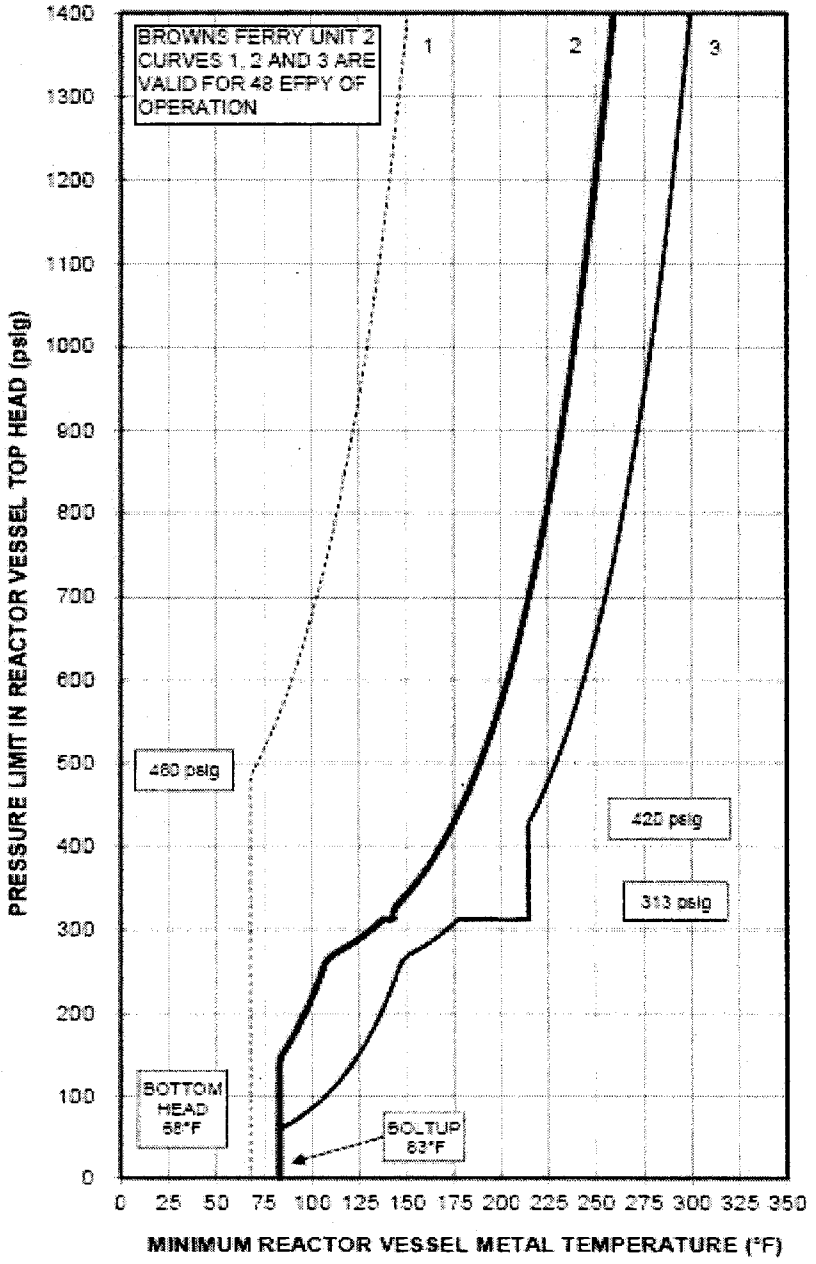
Curve No. 1
Minimum temperature for bottom head during in-service leak or hydrostatic testing.

Curve No. 2
Minimum temperature for upper RPV and beltline during in-service leak or hydrostatic testing.

Notes
These curves include sufficient margin to provide protection against feedwater nozzle degradation. The curves allow for shifts in RT_{NDT} of the Reactor vessel beltline materials, in accordance with Reg. Guide 1.99, Rev. 2, to compensate for radiation embrittlement for 38 EFPY.

The acceptable area for operation is to the right of the applicable curves.

Figure 3.4.9-2
Pressure/Temperature Limits for
Reactor In-Service Leak and Hydrostatic Testing



Curve No. 1
Minimum temperature for bottom head during mechanical heatup or cooldown following nuclear shutdown.

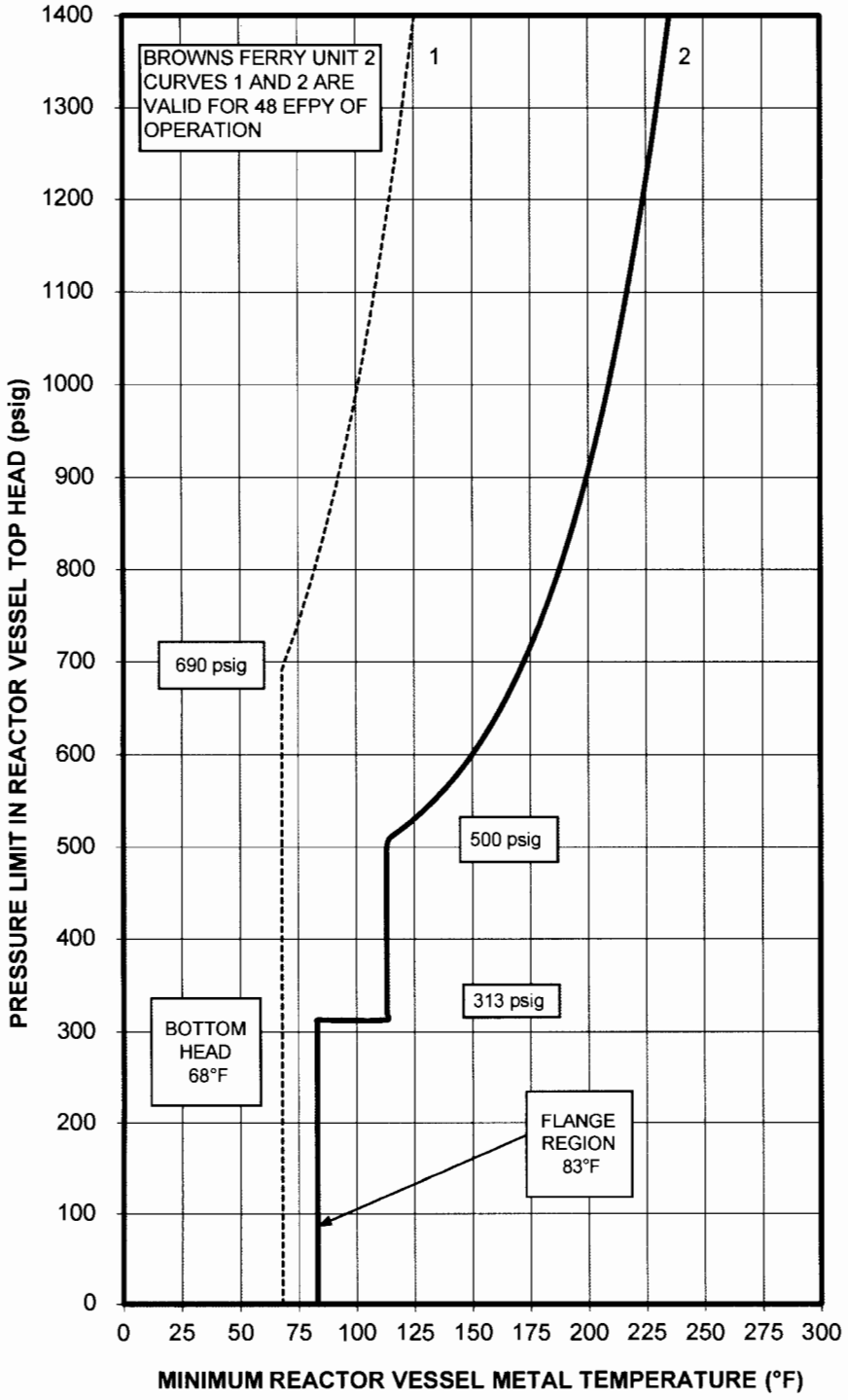
Curve No. 2
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

Curve No. 3
Minimum temperature for core operation (criticality).

Notes
These curves include sufficient margin to provide protection against feedwater nozzle degradation. The curves allow for shifts in RT_{NDT} of the Reactor vessel beltline materials, in accordance with Reg. Guide 1.99, Rev. 2, to compensate for radiation embrittlement for 48 EFPY.

The acceptable area for operation is to the right of the applicable curves.

Figure 3.4.9-1
Pressure/Temperature Limits for Mechanical Heatup, Cooldown following Shutdown, and Reactor Critical Operations



Curve No. 1
Minimum temperature for bottom head during in-service leak or hydrostatic testing.

Curve No. 2
Minimum temperature for upper RPV and beltline during in-service leak or hydrostatic testing.

Notes
These curves include sufficient margin to provide protection against feedwater nozzle degradation. The curves allow for shifts in RT_{NDT} of the Reactor vessel beltline materials, in accordance with Reg. Guide 1.99, Rev. 2, to compensate for radiation embrittlement for 48 EFPY.

The acceptable area for operation is to the right of the applicable curves.

Figure 3.4.9-2
Pressure/Temperature Limits for
Reactor In-Service Leak and Hydrostatic Testing

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 314

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-52

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

By letter dated June 19, 2014, as supplemented by letter dated December 2, 2014, Tennessee Valley Authority (the licensee) submitted an application for amendment for Browns Ferry Nuclear Plant, Unit 2 (BFN-2). These two documents are docketed in the Agencywide Documents Access and Management System (ADAMS) under Accession Nos. ML14175A307 and ML14336A691, respectively. The licensee proposed to revise the BFN-2 Technical Specifications to update the requirements at Section 3.4.9, "RCS [Reactor Coolant System] Pressure and Temperature (P/T) Limits." This update would replace the current P/T limits for the reactor pressure vessel (RPV). The proposed new P/T limits are based on NEDC-33178-A, Revision 1, "GE [General Electric] Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves" (ADAMS Accession No. ML092370487).

The June 19, 2014, submittal includes the Electric Power Research Institute (EPRI)/General Electric – Hitachi (GEH) report NEDC-33854P, "Pressure and Temperature Limits Report (PTLR) Up to 38 and 48 Effective Full Power Years," Revision 0, April 2014." The proposed amendment would replace the existing P/T curves, valid up to 23 and 30 effective full-power years (EFPY), with new P/T limit curves and supporting information valid to 38 and 48 EFPY.

The subject application, as supplemented, satisfies the licensee's prior commitment made in its application for renewed operating license, dated December 31, 2003 (ADAMS Accession No. ML040060359), to prepare and submit revised P/T limits prior to the start of the period of extended operation.

The same commitment, identified as Commitment 39, is described in the NRC staff's, "Safety Evaluation Report Related to the License Renewal of the Browns Ferry Nuclear Plant, Units 1, 2, and 3," to NUREG-1843, dated April 2006 (ADAMS Accession No. ML061030032). Specifically, Commitment 39 states that the licensee will develop and submit revised P/T limit curves for NRC approval prior to the period of extended operation. The "Browns Ferry Nuclear Plant - NRC Post-Approval Site Inspection for License Renewal, Inspection Report," dated October 3, 2013

(Inspection Reports 05000259/2013009, 05000260/2013009, and 05000296/2013009), with respect to Commitment 39, stated that new P/T limits will be calculated and approved before the period of extended operation. The current NRC-approved P/T limit curves were approved prior to the period of extended operation and are applicable for operation into, but not to the end of, the period of extended operation. Therefore, the licensee's proposed P/T limit curves were developed based on analyses projected to the end of the period of extended operation as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 54.21(c)(1)(ii).

2.0 REGULATORY EVALUATION

The NRC has established requirements in 10 CFR 50 to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The NRC staff evaluates the acceptability of a facility's proposed P/T limits curves based on the following NRC regulations:

(1) Appendix G, "Fracture Toughness Requirements," to 10 CFR 50

Appendix G to 10 CFR 50 requires that the P/T limits curves for a facility's RPV be at least as conservative as those obtained by applying the linear elastic fracture mechanics methodology of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). The most recent version of Appendix G to Section XI of the ASME Code that has been endorsed in 10 CFR 50.55a(b)(2), and therefore by reference in 10 CFR 50, Appendix G, is the 2008 Addenda of the ASME Code. This edition of Appendix G to Section XI of the ASME Code incorporates the provisions of ASME Code Case N-588, "Alternative to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels," and ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves." Additionally, Appendix G to 10 CFR 50 imposes minimum head flange temperatures when system pressure is at or above 20 percent of the preservice hydrostatic test pressure.

(2) Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR 50

Appendix H to 10 CFR 50 establishes requirements for each facility related to its RPV material surveillance program and requires periodic testing of RPV material surveillance capsules to monitor the neutron irradiation embrittlement behavior of the RPV materials.

In addition to the above regulatory requirements, the NRC staff follows the guidance of the following documents in performing this type of review:

(3) Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials"

This document contains methodologies for determining the increase in transition temperature and the decrease in upper-shelf energy resulting from neutron radiation.

(4) Generic Letter (GL) 92-01, Revision 1, "Reactor Vessel Structural Integrity"; GL 92-01, Revision 1, Supplement 1, "Reactor Vessel Structural Integrity"

GL 92-01, Revision 1, requested licensees to submit the RPV data for their plants to the NRC for review, and GL 92-01, Revision 1, Supplement 1, requested licensees to provide and assess data from other licensees that could affect their RPV integrity evaluations.

(5) NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 5.3.2, "Pressure-Temperature Limits, Upper-Shelf Energy, and Pressurized Thermal Shock"

Standard Review Plan Section 5.3.2 provides an acceptable method for determining the P/T limits curves for ferritic materials in the beltline of the RPV based on the ASME Code Appendix G methodology.

(6) RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence"

RG 1.190 describes methods and assumptions acceptable to the NRC staff for determining the pressure vessel neutron fluence with respect to the General Design Criteria (GDC) contained in Appendix A to 10 CFR 50. In consideration of the guidance set forth in RG 1.190, GDC 14, 30, and 31 are applicable. GDC 14, "Reactor Coolant Pressure Boundary," requires the design, fabrication, erection, and testing of the reactor coolant pressure boundary to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. GDC 30, "Quality of Reactor Coolant Pressure Boundary," requires, among other things, that components comprising the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical. GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," pertains to the design of the reactor coolant pressure boundary, and states:

> The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.

3.0 TECHNICAL EVALUATION

3.1 Fluence Calculations Evaluation

On page E1-3 of Enclosure 1 of the application, the licensee stated that the P/T limit curves for the unit have been revised based on methodologies consistent with RG 1.190, using plant-specific

material and fluence information. The proposed P/T limit curves reflect changes from those currently licensed. The new P/T limit curves incorporate a revised fluence calculated in accordance with NRC-approved proprietary GE licensing topical report NEDC-32983P-A, Revision 2 (non-proprietary version is NEDO-32983-A, Revision 2, at ADAMS Accession No. ML072480121), representing BFN-2, operating conditions of up to 3952 megawatt thermal (MWt) and incorporate the NRC-approved methodologies described in proprietary GEH topical report NEDC-33178P-A (non-proprietary version is NEDO-33178-A at ADAMS Accession No. ML092370487). The operating condition of up to 3952 MWt represents the TVA planned Extended Power Uprate power level; however, the current licensed power level is 3458 MWt. In addition, the latest information from the Boiling Water Reactor Vessel Internals Project (BWRVIP) Integrated Surveillance Program (ISP) applicable to BFN-2 has been incorporated into the fluence calculations (see details in Section 3.2 below).

In the NRC staff's Safety Evaluation (SE) enclosed in the topical reports NEDC-33178P-A and NEDO-33178-A, the NRC staff stated the following limitation and condition:

> As documented in Section 3.1 of this SE, licensees who chose to implement NEDC-33178, Revision 1, as their facility's PTLR methodology must address one plant-specific action item:
>
> > The licensee must identify the report used to calculate the neutron fluence and document that the plant-specific neutron fluence calculation will be performed using an approved neutron fluence calculation methodology.
>
> Information to address this licensee action item must be submitted with the licensee's requested license amendment to implement a PTLR for its facility.

The PTLR (i.e., NEDC-33854P and NEDO-33854 in the June 19, 2014, application) prepared by EPRI/GEH for the licensee incorporates a fluence calculated in accordance with the GE licensing topical report NEDC-32983P-A, Revision 2, cited above, which has been previously approved by the NRC and found to be in compliance with the guidance of RG 1.190.

The NRC staff's SE approving NEDC-32983-PA, Revision 2, and NEDO-32983-A, Revision 2, provides the NRC staff's evaluation concluding that plant-specific neutron fluence values calculated following this methodology would be considered adherent to the RG 1.190 guidance and, hence, acceptable. RG 1.190 provides guidance concerning the calculation of acceptable reactor pressure vessel neutron fluence values. Since the licensee's fluence calculations were performed in accordance with an NRC-approved methodology and using the guidance in RG 1.190, the NRC staff finds the fluence calculations acceptable insofar as they support the requested PTLR implementation.

The licensee calculated fluence based on 38 and 48 EFPY of exposure for the unit. This calculation was based on the assumption that the core is operating at 3952 MWt licensed extended thermal power level.

Based on its review of the information provided in the licensee's June 19, 2014, submittal, the NRC staff concludes that the licensee's fluence calculations were performed in accordance with

an NRC-approved methodology and used the guidance in RG 1.190. Thus, the NRC staff finds the licensee's fluence calculations support the proposed PTLR and are acceptable.

3.2 New P/T Limits Evaluation

The licensee's revised P/T limits are based on application of GE topical report NEDC-33178-A, which conveys an NRC-approved generic methodology for generating P/T limits based on the plant-specific adjusted reference temperature (ART). The GE methodology provides beltline and generic upper vessel and bottom head P/T limit curves that are shifted by the plant-specific limiting ART, as well as guidance on the application of the ASME Code, Appendix G, and 10 CFR Part 50, Appendix G.

For the RPV beltline material, the licensee identified a material for which the identity and properties are proprietary. The licensee noted that the limiting ART at 48 EFPY is 175 degrees Fahrenheit (°F), which is below the 200 °F criterion of RG 1.99, Revision 2. ART values were calculated for 38 and 48 EFPY. The licensee noted that the N16 water level instrument (WLI) nozzle was evaluated consistent with Appendix J of the GE methodology. The parameters used to determine the licensee's ART values for the limiting materials at one-quarter of the RPV wall thickness (1/4T) location for 38 and 48 EFPY are shown in Enclosure 2 of the application. Corresponding parameters at three-quarter of the RPV wall thickness (3/4T) were not provided in the attachments. Instead, the licensee applied the maximum tensile stress for both heatup and cooldown at the 1/4T location. The licensee stated that this approach is conservative as the 1/4T material toughness is lower than that in the 3/4T locations.

P/T limit Curves A, B, and C for 38 and 48 EFPY were provided in Enclosure 2 (i.e., NEDC-33854P) of the application, and are based on application of the referenced GE methodology. The licensee noted that the P/T limit curves were limited by beltline materials for portions of the curves, stating on page 9:

> ...P-T curves are beltline limited for Curves A, B, and C, for 38 and 48 EFPY. For 38 EFPY, Curve A is beltline limited above 530 psig [pounds per square inch gauge] psig, Curve B is beltline limited between 290 and 313 psig and above 360 psig, and Curve C is beltline limited above 290 psig. For 48 EFPY, Curve A is beltline limited above 500 psig, Curve B is beltline limited between 270 and 313 psig and above 330 psig, and Curve C is beltline limited above 260 psig. For Curve C at 38 EFPY, the upper vessel region is bounding at pressures between 50 and 290 psig. For Curve C at 48 EFPY, the upper vessel region is bounding at pressures between 50 psig and 260 psig.

The licensee provided data from the ISP of BWRVIP-135, "BWR Vessel and Internals Project Surveillance Program (ISP) Data Source Book and Plant Evaluations," in compliance with a commitment stated in NEDC-33178-A. The BWRVIP-135 source book is used by the industry in compliance with BWRVIP-86NP, Revision 1, "BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan" (ADAMS Accession No. ML090300556). Information was also included detailing the determination process for evaluating non-beltline but potentially limiting components.

The licensee's proposed P/T limits are a composite of the RPV beltline, the bottom head, and the upper vessel curves. P/T curves generated independently by the NRC staff were found to be consistent with P/T curves provided by the licensee. These curves were generated using the NEDC-33178-A GE methodology and ASME Code, Section XI, Appendix G.

To evaluate the proposed BFN-2, RPV beltline P-T limits, the NRC staff first confirmed the licensee's selection of limiting materials. For this, the NRC staff found that the initial RT_{NDT}, copper, and nickel values were largely in agreement with information previously accepted by the NRC staff as part of the current licensing bases.* The licensee reported best-estimate chemistry and ISP data from BWRVIP-86, Revision 1, to confirm the collection of credible chemistry and surveillance data. The NRC staff found that best-estimate chemistry data from BWRVIP-86 do not substantively differ from the information previously accepted by the NRC staff as part of the current licensing bases, and therefore the inclusion of best-estimate chemistry does not change the limiting beltline material previously identified by the NRC staff. The licensee only calculated ART values for the RPV 1/4T location. The NRC staff concurs that this is reasonable, as the licensee's approach of using the maximum tensile stress for either heatup or cooldown and applying it at the 1/4T location is equivalent to using the maximum thermal stress intensity factor and the minimum fracture toughness in the heatup and cooldown analysis, making the proposed P-T limits bound both the heatup and cooldown curves.

The licensee provided composite and limiting P/T limit Curves A, B, and C. The composite curves are consistent with composite curves generated independently by the NRC staff applying the GE methodology, shifting the approved generic GE curves by the ART for the limiting material identified. For all conditions, the Appendix G to 10 CFR Part 50 requirements for the minimum metal temperature of the closure head flange and vessel flange regions produce limiting "notches," serving to explain the distinct vertical lines at constant temperature above ~313 psig in the licensee's proposed P/T limits. The licensee had updated the hydro test pressure from 312 to 313 psig based on its Form N-1A Manufacturers Data Report for Nuclear Vessels. For all BFN-2 curves, a minimum temperature of 68 °F for the bottom head and 83 °F for the flange region was verified as being ASME Code-compliant per the stipulation that these regions must be at least RT_{NDT} + 60 °F (where RT_{NDT} represents that property of the limiting material in the relevant region). When P > 313 psig, the minimum temperature of 113 °F for the pressure test curve, 143 °F for the normal operation/core not critical curve, and 214.6 °F for the normal operation/core critical curve were not all derived from adding 90 °F, 120 °F, and 160 °F to the RT_{NDT} of 23 °F for the limiting flange material as specified in Appendix G to 10 CFR Part 50 for the three operation conditions. The NRC staff requested that the licensee clarify how these values were calculated, and the licensee provided the calculations in its December 2, 2014, letter. The licensee indicated that the 214.6 °F value for the normal operation/core critical curve was derived from the minimum permissible temperature for inservice system hydrostatic pressure testing consistent with 10 CFR 50, Appendix G, requirements.

The licensee noted that nozzle N16, a beltline WLI nozzle, was evaluated and not found to be bounding. The NRC staff reviewed the dispositioning of this and other relevant nozzles against the GE methodology, staff approval of the methodology, and current staff practice and determined that they were adequately addressed in Enclosure 2 of the submittal.

*See http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/prv.html for general information on reactor vessel materials programs.

The NRC staff also reviewed the licensee's analysis of non-beltline components and materials as documented in Enclosure 2 of the application. In many plant designs, the material properties of the beltline have been controlled such that geometric and non-beltline materials may in fact be the limiting factors in portions of P/T limits. The discussion presented in Enclosure 2 of the application clarified precisely how each non-beltline portion of the RPV was analyzed and a curve generated for it. This analysis resulted in three curves, one for the upper vessel, one for the vessel head, and one for the vessel bottom head. Discontinuities were addressed as well and found to be bounded by the afore-mentioned curves. The discussion also addressed reactor coolant pressure boundary piping, pumps, valves, tubing, and welds, citing compliance with ASME Code Section XI, Appendix G, Article G-3000, paragraph G-3100. The licensee further cited compliance with ASME Code Section III, Paragraph NB-2332, as demonstrating that no reactor coolant pressure boundary piping components require consideration in the RPV P/T curves. The NRC staff concurs with this assessment.

Based on the above evaluation, the NRC staff determined that the licensee's proposed P/T limits are in accordance with the NEDC-33178-A GE methodology and satisfy the requirements of Appendix G to Section XI of the ASME Code and Appendix G to 10 CFR Part 50. Hence, the licensee's proposed P/T limit curves are acceptable.

3.3 Summary of Technical Evaluation

The NRC staff performed independent evaluations and verified that the licensee's proposed P/T limits were developed appropriately using the NEDC-33178-A methodology, and that the proposed P/T limits, valid for 38 and 48 EFPY, satisfy the requirements of Appendix G to Section XI of the ASME Code and Appendix G to 10 CFR Part 50. Based on its review, the NRC staff concludes that the proposed BFN-2, P/T limits, conveyed as new pages 3.4-26, 3.4-29, 3.4-29a, 3.4-29b, and 3.4-29c, are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Alabama State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (80 FR 5819; February 3, 2015). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: George Thomas, NRR
Dan S. Widrevitz, NRO

Date: June 2, 2015

The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA by PTam for/

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-260

Enclosures:
1. Amendment No. 314 to License No. DPR-52
2. Safety Evaluation

cc with enclosures: Addressee only
Distribution via Listserv (10 days after issuance of the amendment to the licensee)

DISTRIBUTION:
NON-PUBLIC (**No PDC/ListServ for 10 working days**)

LPL2-2 R/F	RidsNrrDorlLpl2-2	RidsNrrLABClayton
RidsNrrDssStsb	RidsNrrPMBrownsFerry	RidsACRS_MailCTR
RidsNrrDorlDpr	RidsRgn2MailCenter	PPurtscher, NRR
RidsRgn2MailCenter	RidsNrrDeEvib	MHardgrove, NRR
LRonewicz, NRR	RidsNrrDssSrxb	PTam, NRR
RidsNrrDraArcb	GThomas, NRR	DWidrevitz, NRO

ADAMS Accession No.: ML15065A049 *by memo ML14353A163 **by memo ML14204A295

OFFICE	DORL/LPL4-1/PM	DORL/LPL2-2/LAiT	DORL/LPL2-2/LA	DE/EVIB/BC*	DRA/ARCB/BC**
NAME	PTam	LRonewicz	BClayton	SRosenberg	UShoop
DATE	3/6/15	3/11/15	3/11/15	1/8/15	8/26/14
OFFICE	DORL/LPL2-2/PM	DSS/STSB/BC	OGC - NLO	DORL/LPL2-2/BC	DORL/LPL2-2/PM
NAME	FSaba (PTam for)	RElliott	AGhosh	SHelton	FSaba (PTam for)
DATE	4/7/15	5/1/15	4/30/15	5/29/15	6/2/15

OFFICIAL RECORD COPY