Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

August 7, 2003

TVA-BFN-TS-441 10 CFR 50.90

U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

Gentlemen:

In the Matter of) Docket Nos. 50-260
Tennessee Valley Authority) 50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 2 and 3 - TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441 - UPDATE OF PRESSURE-TEMPERATURE (P-T) CURVES

Pursuant to 10 CFR 50.90, TVA is submitting a request for a TS change (TS-441) to licenses DPR-52 and DPR-68 for BFN. The proposed TS change revises the reactor vessel P-T limit curves for both units. The proposed P-T curves were developed in accordance with 10 CFR 50 Appendix G and the 1998 Edition with 2000 Addenda of ASME Section XI, which directly incorporates ASME Code Cases N-588 and N-640. Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 13, states that these code cases are acceptable for use in licensee Section XI inservice inspection programs.

The proposed change revises the reactor vessel P-T limits depicted on current TS Figure 3.4.9-1 and adds a new TS Figure 3.4.9-2 for each unit. Curves specific to the reactor bottom head region are being added to the TS via these figures. The revised P-T limits being requested were calculated using neutron fluence values of 1.33E18 n/cm^2 at 30 Effective Full

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Power Years (EFPY) for Unit 2 and 1.24E18 n/cm^2 at 28 EFPY for Unit 3. These EFPY values represent the estimated service lives which will have been reached by Unit 2 and Unit 3 at the expiration of their current operating licenses. These fluence values conservatively assume operation over the entire analyzed period at an extended power uprate condition of 3952 MWt. This power level is 114.2% of the currently licensed power, and it is 120% of the BFN units' original licensed power. The fluence values were calculated in accordance with General Electric (GE) Licensing Topical Report NEDC-32983P, which was approved by an NRC safety evaluation report (TAC MA9891), dated September 14, 2001. The methodology is in compliance with NRC Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."

The present Unit 2 P-T curves are valid to 17.2 EFPY and the Unit 3 curves are valid to 13.1 EFPY. At historical operating capacity factors, both BFN units will reach the end of their currently authorized P-T curves by approximately June 2004.

TVA is requesting approval of Unit 2 curves calculated for 23 EFPY and Unit 3 curves calculated for 20 EFPY for use in the TS. Additionally, TVA is submitting P-T curves which are calculated using the full amount of EFPY which is anticipated will have been accrued at the end of the units' current operating licenses, 30 EFPY for Unit 2 and 28 EFPY for Unit 3. These curves will not be inserted into the TS at this time; however, NRC is requested to approve these curves. These 30/28 EFPY curves were calculated in the same manner as the 23/20 EFPY curves, therefore, a technical review of these curves at this time can be accomplished in an efficient manner. TVA will replace the 23/20 EFPY curves in the TS with the 30/28 curves before expiration of the 23/20 curves. By initially utilizing the 23/20 EFPY curves, the appropriate P-T margins will be conservatively maintained, maximum operational flexibility will remain available for plant activities, and the TS figures will not contain unnecessary information.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosures to the Alabama State Department of Public Health.

Enclosure 1 to this letter provides the description and evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration and is exempt from environmental review. Enclosure 2 contains marked up pages of the appropriate TS for Unit 2 and Unit 3. Enclosure 3 contains copies of the revised pages as they would appear following approval of this request. Enclosure 4 contains the 30/28 EFPY P-T curves. Enclosures 5 and 6 contain copies of the GE reports from which the submitted Unit 2 and Unit 3 P-T curves were taken.

Please note that the GE reports in Enclosure 5 contain information that the General Electric Company considers to be proprietary in nature and subsequently, pursuant to 10 CFR 9.17(a)(4), 2.790(a)(4) and 2.790(d)(1), requests that such information be withheld from public disclosure. Each report contains an affidavit supporting this request. Enclosure 6 contains the redacted versions of these same reports, with the GE proprietary material removed, suitable for public disclosure.

TVA requests NRC approval of this TS change by February 27, 2004, to allow use of the new curves during reactor pressure testing prior to start-up from the Unit 3 Cycle 11 refueling outage. TVA requests that the revised TS be made effective within 30 days of NRC approval.

There are no regulatory commitments associated with this submittal. This letter is being sent in accordance with NRC RIS 2001-05, "Guidance on Submitting Documents to the NRC by Electronic Information Exchange or CD-ROM."

If you have any questions about this change, please telephone me at (256) 729-2636.

I declare under penalty of perjury that the forgoing is true and correct. Executed on this 7th day of August, 2003.

Sincerely,

T. E. Abney
Manager of Licensing
and Industry Affairs

Enclosure 1 - Evaluation of Proposed Change
Enclosure 2 - Marked Pages
Enclosure 3 - Revised Pages
Enclosure 4 - Unit 2 30 EFPY and Unit 3 28 EFPY Figures
Enclosure 5 - Proprietary Supporting Information
Enclosure 6 - Non-proprietary Supporting Information

cc (Enclosures):

State Health Officer
Alabama Department of Public Health
RSA Tower - Administration
Suite 1552
P.O. Box 303017
Montgomery, Alabama 36130-3017

ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY (TVA)
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 2 AND 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441
TVA EVALUATION OF PROPOSED CHANGE

1.0 DESCRIPTION

This letter is a request to amend Operating Licenses DPR-52 and DPR-68 for Browns Ferry Nuclear Plant (BFN) Units 2 and 3, respectively. The proposed amendment revises the Unit 2 and Unit 3 reactor vessel pressure-temperature (P-T) curves to reflect the results of an analysis which calculates the Unit 2 curves for 23/30 Effective Full Power Years (EFPY) and the Unit 3 curves for 20/28 EFPY of reactor operation.

The present BFN P-T curves are valid up to 17.2 EFPY for Unit 2 and up to 13.1 EFPY for Unit 3. At historical operating capacity factors, both BFN units will reach these EFPY limits by approximately June 2004. TVA requests NRC approval of this TS change by February 27, 2004, to allow use of the new curves during reactor pressure testing prior to start-up from the Unit 3 Cycle 11 refueling outage.

2.0 PROPOSED CHANGE

The specific changes are described below.

1. TS Figure 3.4.9-1 for Unit 2 and Unit 3 is deleted and replaced in its entirety.

2. The new TS Figure 3.4.9-1 contains an added curve which specifically details reactor vessel bottom head temperature versus pressure limitations for non-critical heatup/cooldown operational conditions.

3. A new TS Figure 3.4.9-2 has been added which contains curves for the reactor vessel bottom head and the upper vessel/beltline regions for in-service leak and hydrostatic testing activities.

4. The legend information on these TS figures has been revised to appropriately describe the additional curves and their usage.

5. References to these figures within the TS body have been revised as necessary to appropriately reflect their use.

3.0 BACKGROUND

The present BFN P-T curves are valid up to 17.2 EFPY for Unit 2 and up to 13.1 EFPY for Unit 3. At historical operating capacity factors, both BFN units will reach these EFPY limits by approximately June 2004. As well as extending the EFPY limits, the requested P-T curves will allow for improved flexibility during reactor in-service and hydrostatic pressure testing. The addition of the separate, specific bottom head curves provides this improved flexibility. Inclusion of the new bottom head curves directly on the TS figures will more clearly delineate the reactor vessel bottom head temperature limits, which are distinct from the temperature limits for the beltline and upper vessel regions.

4.0 TECHNICAL ANALYSIS

P-T Curve Overview

All components of the reactor coolant system are designed to withstand effects of cyclic loads due to system pressure and temperature changes. These loads are introduced by startup (heatup) and shutdown (cooldown) operations, power transients, and reactor trips. Therefore, P-T limits are established to ensure the reactor coolant system is operated under conditions that preclude brittle failure of the reactor coolant pressure boundary.

10 CFR 50 Appendix G requires the establishment of these P-T limits for reactor coolant pressure boundary materials. Appendix G also requires an adequate margin to brittle failure be maintained during normal operation, anticipated operational occurrences, and system hydrostatic tests. The P-T limits are acceptance limits in themselves, since operation in accordance with these limitations precludes operation in an unanalyzed condition. The P-T limits are not derived from Design Basis Accident analyses.

The proposed P-T limit curves are composite curves established by superimposing limits derived from stress analyses of those portions of the reactor vessel and head that are the most restrictive. At any specific pressure, temperature, and temperature rate of change, one location within the reactor vessel will dictate the most restrictive limit. Across the span of the P-T limit curves, different locations are more restrictive, and, thus, the curves are composites of the most restrictive regions.

For BFN Unit 2 and Unit 3, the P-T limits are currently specified in TS Figure 3.4.9-1. The existing figure contains three separate P-T curves, which define the P-T limitations for the entire reactor pressure vessel for the following reactor operating conditions.

- Curve 1 includes P-T restrictions on reactor vessel head boltup. Hydrostatic/leak testing of the reactor vessel is performed in accordance with these limitations prior to startup after a refueling outage to verify that the vessel is leak tight. The minimum allowable testing temperatures are established by the P-T curves.
- Curve 2, the heatup and cooldown curve, is used for startup and shutdown operations when the core is not critical.
- Curve 3 specifies the P-T limits during operations when the core is critical. The primary system pressure and temperature are monitored and compared to the applicable curve to ensure that operation is within the allowable region.

The new P-T curve set being requested includes two additional curves. These are:

- A fourth curve which specifies the temperature limits for the reactor vessel bottom head region during in-service and hydrostatic testing of the reactor vessel. The minimum temperature for the bottom head during this testing is established by this P-T curve.
- A fifth curve which specifies the temperature limits on the reactor vessel bottom head during startup and shutdown operations when the reactor is not critical.

These five separate curves are depicted on the revised TS Figure 3.4.9-1 and new Figure 3.4.9-2 to clearly show the P-T limitations for the reactor bottom head area and the vessel beltline and upper vessel areas for all operating conditions.

Methodology

The P-T limits are primarily dependent upon the fracture toughness of the vessel ferritic materials. The key parameters which characterize a material's fracture toughness are the reference temperature of nil-ductility transition

(RT_{NDT}) and the Upper Shelf Energy (USE). These parameters are defined in 10 CFR 50 Appendix G and in Appendix G of the ASME Boiler and Pressure Vessel Code, Section XI. These documents also contain the requirements used to establish the P-T operating limits that must be met to avoid brittle fracture.

Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," provides an acceptable method for calculating P-T limits that satisfies the requirements of 10 CFR 50 Appendix G. The P-T curves for BFN Unit 2 and Unit 3 have been recalculated based on methodologies that are in accordance with this regulatory guide using plant-specific material and fluence information. The BFN Units 1, 2, and 3 specific RT_{NDT}, weld material composition, and fluence information have been previously provided by TVA to NRC (see References 1-10). The fluence values used in development of these curves were calculated in accordance with General Electric (GE) Licensing Topical Report NEDC-32983P, which was approved by an NRC safety evaluation report (TAC MA9891), dated September 14, 2001.

Principal assumptions for this analysis include:

- hydrostatic pressure testing will be conducted at or below 1064 psig
- Maximum values of 30 EFPY for Unit 2 and 28 EFPY for Unit 3 which will be reached within the limits of the current operating licenses. Midpoint values at 23 EFPY and 20 EFPY for Units 2 and 3, respectively, are also calculated
- 1.4E09 n/cm^2-sec peak neutron flux at extended power uprate (EPU) conditions of 3952 MWt. Note that this power is 114.2% of the currently licensed power, and it is 120% of the originally licensed power for Unit 2 and Unit 3. This flux is assumed over the entire calculated EFPY period, even though at this time neither Unit 2 nor Unit 3 has operated at the EPU power level.

Results

The following fluence values were calculated using the EPU flux of 1.4E09 n/cm^2-sec.

Unit 2 23 EFPY fluence:	1.0E18 n/cm^2
Unit 2 23 EFPY 1/4T fluence for lower-intermediate shell plate and axial welds:	7.0E17 n/cm^2
Unit 2 23 EFPY 1/4T fluence for lower shell plate and axial welds and lower to lower-intermediate girth weld:	5.7E17 n/cm^2
Unit 2 30 EFPY fluence:	1.33E18 n/cm^2
Unit 2 30 EFPY 1/4T fluence for lower-intermediate shell plate and axial welds:	9.2E17 n/cm^2
Unit 2 30 EFPY 1/4T fluence for lower shell plate and axial welds and lower to lower-intermediate girth weld:	7.4E17 n/cm^2

Unit 3 20 EFPY fluence:	8.9E17 n/cm^2
Unit 3 20 EFPY 1/4T fluence for lower-intermediate shell plate and axial welds:	6.1E17 n/cm^2
Unit 3 20 EFPY 1/4T fluence for lower shell plate and axial welds and lower to lower-intermediate girth weld:	5.0E17 n/cm^2
Unit 3 28 EFPY fluence:	1.24E18 n/cm^2
Unit 3 28 EFPY 1/4T fluence for lower-intermediate shell plate and axial welds:	8.6E17 n/cm^2
Unit 3 28 EFPY 1/4T fluence for lower shell plate and axial welds and lower to lower-intermediate girth weld:	6.9E17 n/cm^2

The limiting adjusted reference temperature (ART) values of 141°F for the 30 EFPY Unit 2 calculation and 138°F for the 28 EFPY Unit 3 calculation remain well below the 200°F criterion of RG 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2. The USE equivalent margin analyses values calculated for end of life (i.e., 30 EFPY for Unit 2 and 28 EFPY for Unit 3) remain within the limits of RG 1.99, Revision 2 and 10 CFR 50 Appendix G. A single set of P-T curves for the heatup and cooldown operating condition at a given EFPY that apply for both the 1/4T and 3/4T locations was developed. When combining pressure and thermal stresses, it is usually necessary to evaluate stresses at the 1/4T location (assumed inside surface flaw) and the 3/4T location (assumed outside surface flaw). This is because the thermal gradient tensile stress of interest is in the inner wall during cooldown and is in the outer wall during heatup. However, as a conservative simplification, the thermal gradient stress at the 1/4T location is assumed to be tensile for both heatup and cooldown. This results in the approach of applying the maximum tensile stress at the 1/4T location. This approach is conservative because irradiation effects cause the allowable toughness, K_{IR}, at 1/4T to be less than that at 3/4T for a given metal temperature. This approach causes no operational difficulties, since the boiling water reactor is at steam saturation conditions during normal operation, well above the heatup/cooldown curve limits.

The GE reports for Unit 2 and Unit 3 provided in Enclosure 5 demonstrate the technical methods and contain the data for producing the composite P-T curves which are to be placed in the TS. Table B-2 in the Unit 2 report contains the data for producing the composite 23 EFPY curves. In the same manner, Table B-4 of the Unit 2 report contains the data for producing the composite 30 EFPY curves. For Unit 3, Table B-2 contains the data for the 20 EFPY composite curves, and Table B-4 the data for the 28 EFPY composite curves.

Conclusion

The proposed P-T curves have been developed utilizing the methodology of RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," and ASME Section XI. The regulatory guidance provides an allowance for margin to be included in the bounding values of the ART. Use of this methodology ensures that adequate safety margins are maintained. In addition, the analysis conforms to the requirements of 10 CFR 50 Appendix G which ensures that the most limiting material is considered in the development of the P-T curves. The vessel is in compliance with the regulatory requirements, adequate safety margins are maintained, and, therefore, Unit 2 operation to 23 or 30 EFPY and operation of Unit 3 to 20 or 28 EFPY will not have an adverse effect on reactor vessel fracture toughness.

5.0 REGULATORY SAFETY ANALYSIS

Pursuant to 10 CFR 50.90, TVA is submitting a request for a Technical Specifications (TS) change (TS-441) to licenses DPR-52 and DPR-68 for BFN. The proposed change revises the reactor vessel pressure-temperature (P-T) limits depicted on current TS Figure 3.4.9-1 and adds a new TS Figure 3.4.9-2 for each unit. Curves specific to the reactor bottom head region are also being added to the TS via these figures.

5.1 No Significant Hazards Consideration

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed Unit 2 and Unit 3 changes deal exclusively with the reactor vessel P-T curves, which define the permissible regions for operation and testing. Failure of the reactor vessel is not considered as a design basis accident. Through the design conservatisms used to calculate the P-T curves, reactor vessel failure has a low probability of occurrence and is not considered in the safety analyses. The proposed changes adjust the reference temperature for the limiting material to account for irradiation effects and provide the same level of protection as previously evaluated and approved. The adjusted reference temperature calculations were performed in accordance with the requirements of 10 CFR 50 Appendix G using the guidance contained in Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," to reflect use of the operating limits to no more than 30 Effective Full Power Years (EFPY) for Unit 2 or 28 EFPY for Unit 3. These changes do not alter or prevent the operation of equipment required to mitigate any accident analyzed in the BFN Final Safety Analysis Report. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed changes to the Unit 2 and Unit 3 reactor vessel P-T curves do not involve a modification to plant equipment. No new failure modes are introduced. There is no effect on the function of any plant system, and no new system interactions are introduced by this change. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The proposed curves conform to the guidance contained in Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," and maintain the safety margins specified in 10 CFR 50 Appendix G. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment(s) present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The regulatory requirements for fluence calculations are in General Design Criteria (GDC) 30 and 31. NRC issued RG 1.190 in March 2001, which provided state-of-the-art calculations and measurement procedures that are acceptable to the NRC staff for determining pressure vessel fluence. NRC has approved vessel fluence calculation methodologies which satisfy the requirements of GDC 30 and 31 and are done with approved methodologies or with methods which are shown to adhere to the guidance in RG 1.190. The analyses supporting this submittal were performed in accordance with RG 1.190 guidance.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) 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.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from TVA to NRC, dated February 6, 2002, Browns Ferry Nuclear Plant - Reduction in Effective Full Power Years (EFPY) for Technical Specifications (TS) Change 414 - Pressure-Temperature (P-T) Curve Update

2. Letter from TVA to NRC, dated December 14, 2001, Browns Ferry Nuclear Plant - TVA Responses to NRC Requests for Additional Information (RAI) Regarding Units 2 and 3 - Technical Specifications (TS) Change 414 - Pressure-Temperature (P-T) Curve Update

3. Letter from TVA to NRC, dated August 17, 2001, Browns Ferry Nuclear Plant - Units 2 and 3 - Technical Specifications (TS) Change No. 414 - Pressure - Temperature (P-T) Curve Update

4. Letter from TVA to NRC, dated December 15, 1998, Browns Ferry Nuclear Plant - Units 2 and 3 - TS Change No. 393, Supplement 1, P-T Curve Update

5. Letter from TVA to NRC, dated March 3, 1998, Browns Ferry Nuclear Plant - Units 2 and 3 - TS Change No. 393, P-T Curve Update

6. Letter from TVA to NRC, dated March 27, 1995, Generic Letter 92-01, Reactor Vessel Structural Integrity - Update To The Initial Reference Nil-Ductility Temperature (RTNDT), Chemical Composition And Fluence Values

7. Letter from TVA to NRC, dated July 28, 1994, Supplemental Response To TVA Letter dated May 23, 1994, Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity

8. Letter from TVA to NRC, dated May 23, 1994, TVA's response to NRC's letter dated April 19, 1994, "Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity"

9. Letter from TVA to NRC, dated August 2, 1993, Response To Request For Additional Information, Generic Letter 92-01, Revision 1

10. Letter from TVA to NRC, dated July 7, 1992, Browns Ferry Nuclear Plant (BFN), Sequoyah Nuclear Plant (SQN), Watts Bar Nuclear plant (WBN), Response To Generic Letter 92-01 (Reactor Vessel Structural Integrity)

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 2 AND 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441
MARKED PAGES

The surveillance information has been updated to reflect the addition of Figure 3.4.9-2.

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 > 312 psig. 2. The limits of Figure ~~*3.4.9-1, Curve No. 1,*~~ ***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 Figure*s* 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** ~~in~~ Figures 3.4.9-1 and **3.4.9-2**~~*(Curve No. 1 and Curve No. 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

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.9.5	------------------------NOTES------------------------ 1. Only required to be performed when tensioning the reactor vessel head bolting studs. 2. The reactor vessel head bolts may be partially tensioned (four sequences of the seating pass) provided the studs and flange materials are > 70°F. --- Verify reactor vessel flange and head flange temperatures are > ~~82~~***83***°F.	30 minutes
SR 3.4.9.6	------------------------NOTE------------------------ Not required to be performed until 30 minutes after RCS temperature ≤ 85°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > ~~82~~***83***°F.	30 minutes
SR 3.4.9.7	------------------------NOTE------------------------ Not required to be performed until 12 hours after RCS temperature ≤ 100°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > ~~82~~***83***°F.	12 hours

Curve Legends have been revised on new TS pages to include the additional curves, their applicability, and the new Unit 2 valid EFPY interval of 23 years

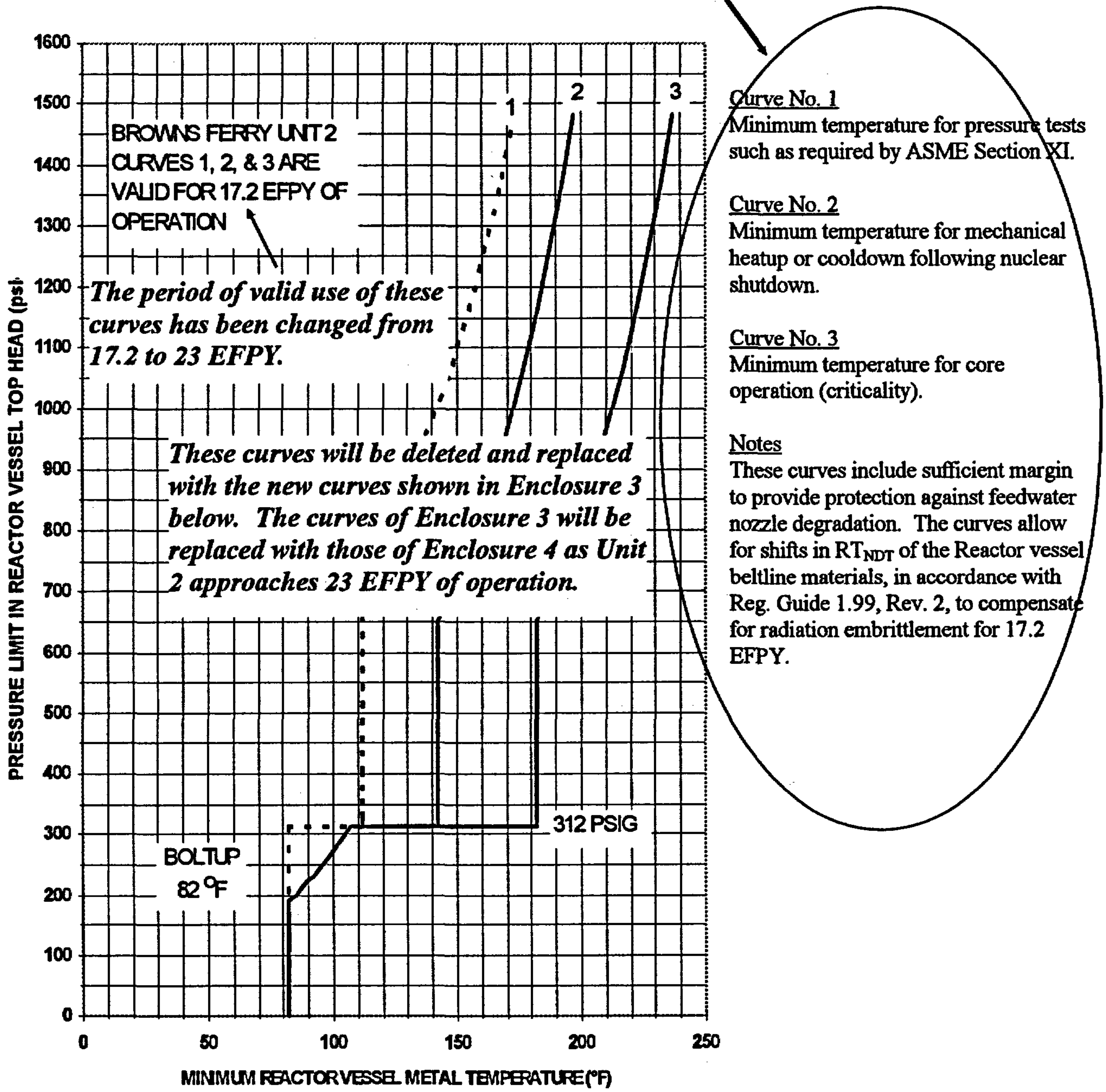


Figure 3.4.9-1
Pressure/Temperature Limits

SURVEILLANCE REQUIREMENTS

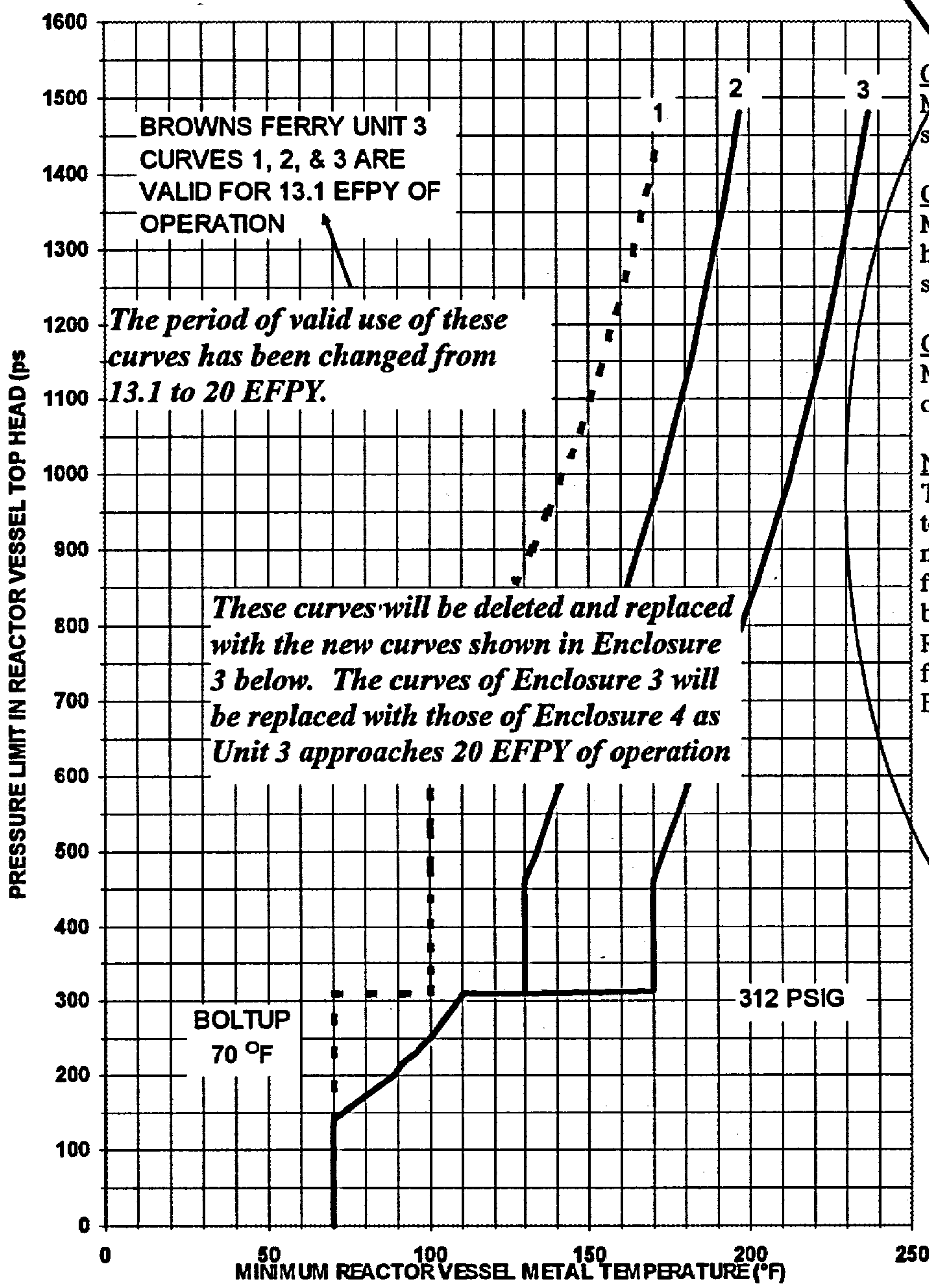
SURVEILLANCE		FREQUENCY
SR 3.4.9.1	-----NOTES----- 1. Only required to be performed during RCS heatup and cooldown operations or RCS inservice leak and hydrostatic testing when the vessel pressure is > 312 psig. 2. The limits of Figure ~~*3.4.9-1, Curve No. 1,*~~ ***3.4.9-2*** may be applied during nonnuclear 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 Figure*s* 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** ~~**in**~~ Figures 3.4.9-1 and **3.4.9-2**~~*(Curve No. 1 and Curve No. 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)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.9.5 -------------------------NOTES-------------------- 1. Only required to be performed when tensioning the reactor vessel head bolting studs. 2. The reactor vessel head bolts may be partially tensioned (four sequences of the seating pass) provided the studs and flange materials are > 70°F. -- Verify reactor vessel flange and head flange temperatures are > ~~70~~***83***°F.	30 minutes
SR 3.4.9.6 -------------------------NOTE---------------------- Not required to be performed until 30 minutes after RCS temperature ≤ 85°F in MODE 4. -- Verify reactor vessel flange and head flange temperatures are > ~~70~~***83***°F.	30 minutes
SR 3.4.9.7 -------------------------NOTE---------------------- Not required to be performed until 12 hours after RCS temperature ≤ 100°F in MODE 4. -- Verify reactor vessel flange and head flange temperatures are > ~~70~~***83***°F.	12 hours

Curve Legends have been revised on new TS pages to include the additional curves, their applicability, and the new Unit 3 valid EFPY interval of 20 years



Curve No. 1
Minimum temperature for pressure tests such as required by ASME Section XI.

Curve No. 2
Minimum temperature for 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 13.1 EFPY.

Figure 3.4.9-1
Pressure/Temperature Limits

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
Units 2 and 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441
REVISED PAGES

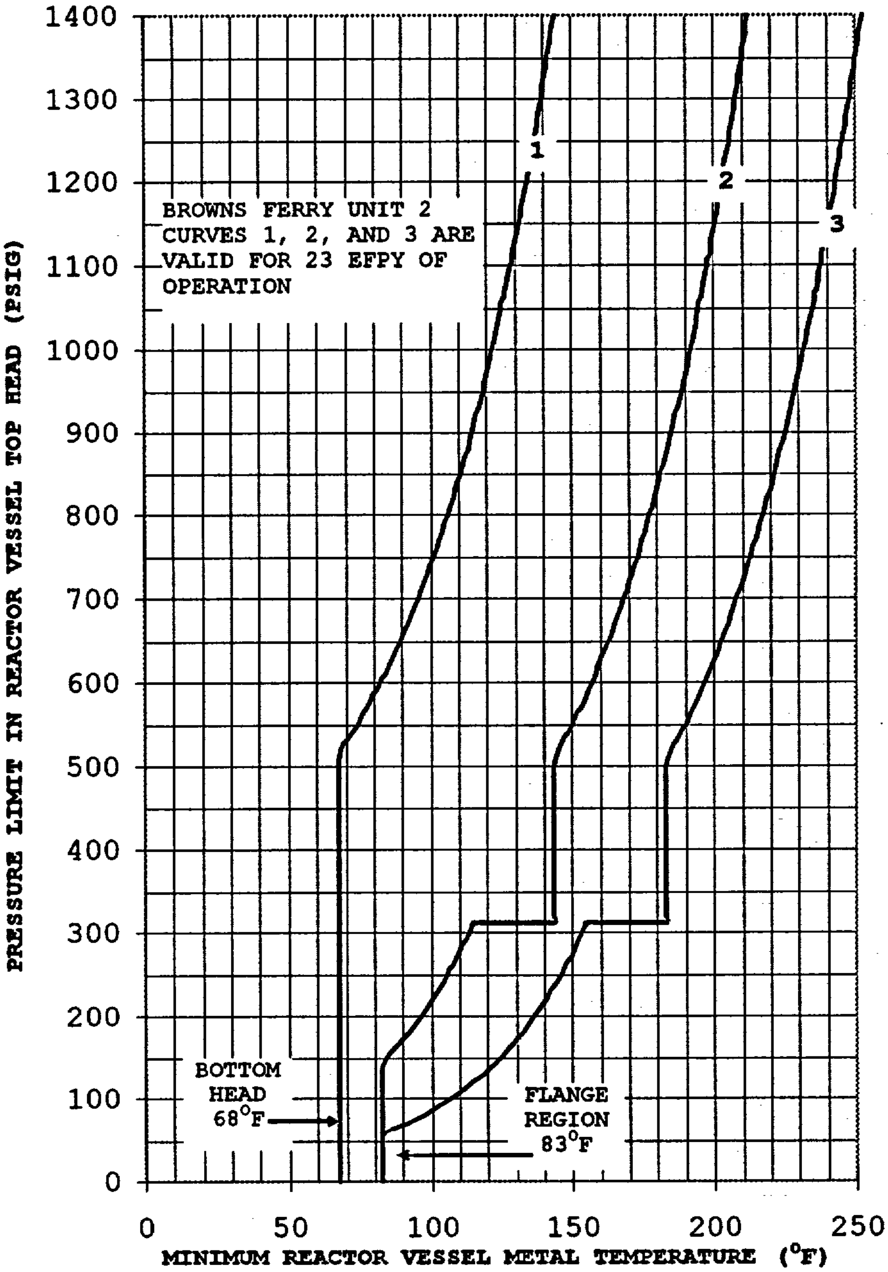
SURVEILLANCE REQUIREMENTS

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 > 312 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)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.9.5 ------------------------NOTES---------------------- 1. Only required to be performed when tensioning the reactor vessel head bolting studs. 2. The reactor vessel head bolts may be partially tensioned (four sequences of the seating pass) provided the studs and flange materials are > 70°F. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	30 minutes
SR 3.4.9.6 ------------------------NOTE---------------------- Not required to be performed until 30 minutes after RCS temperature ≤ 85°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	30 minutes
SR 3.4.9.7 ------------------------NOTE---------------------- Not required to be performed until 12 hours after RCS temperature ≤ 100°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	12 hours



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

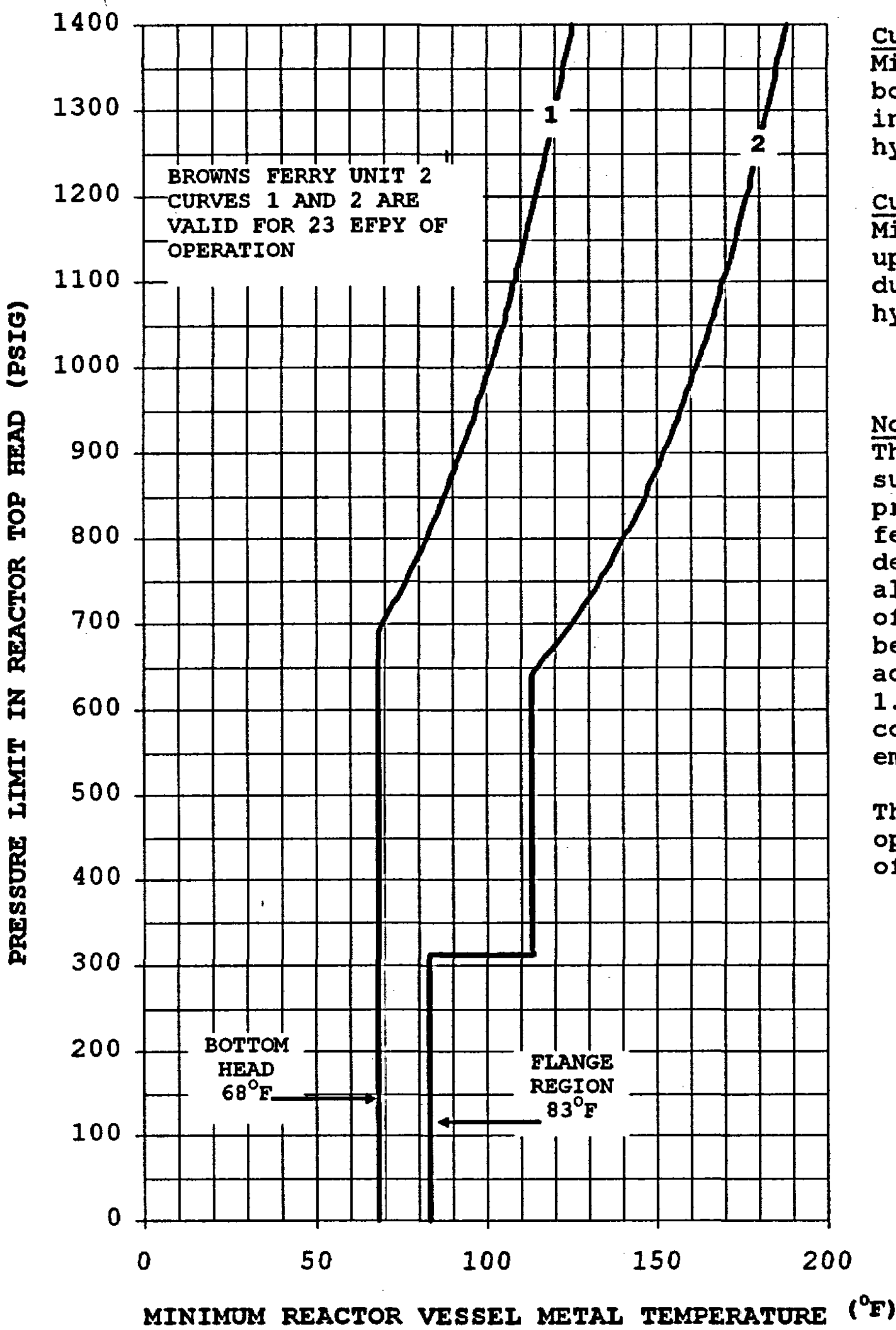
Curve No. 2
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

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 23 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 23 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

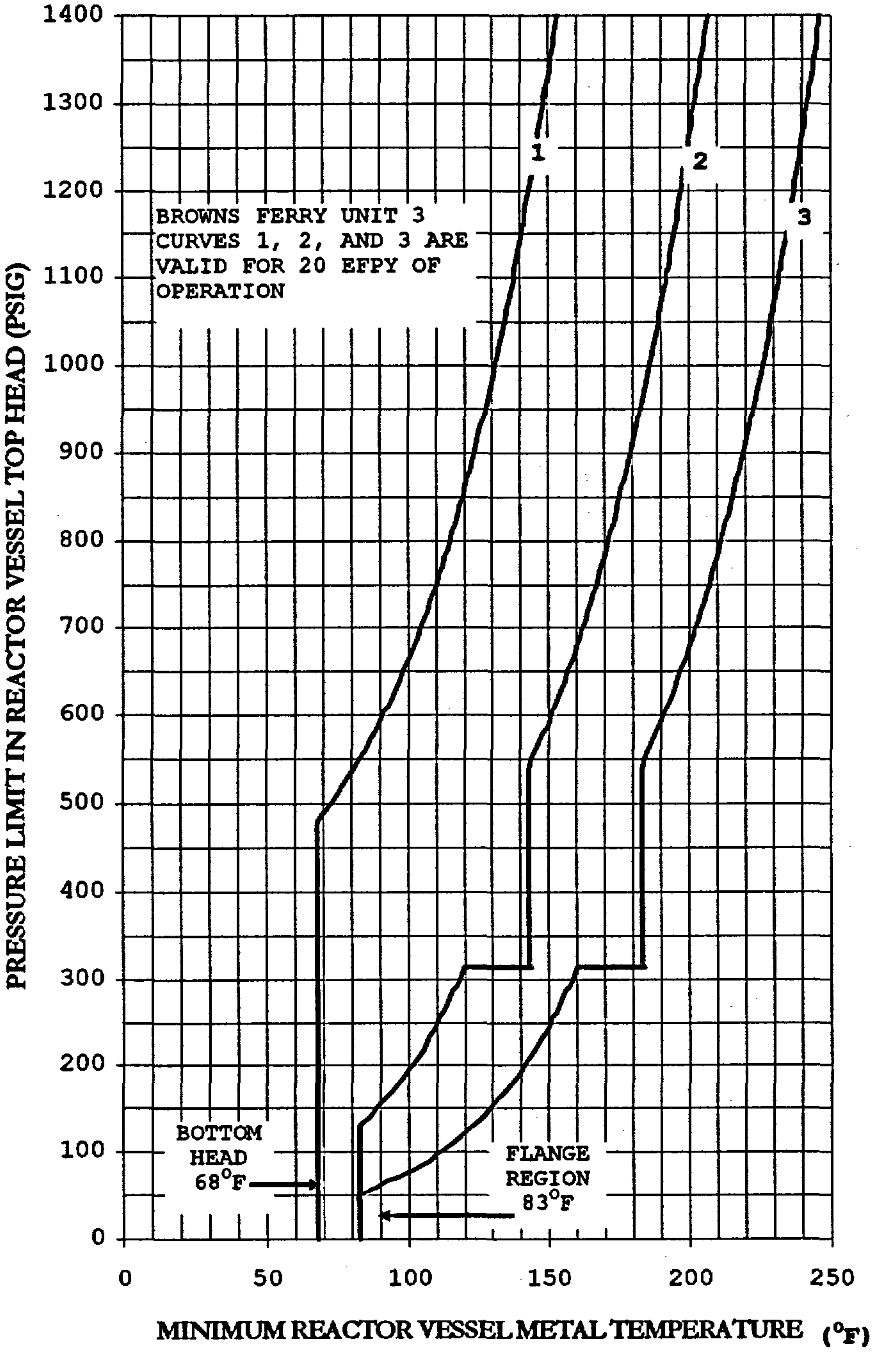
SURVEILLANCE REQUIREMENTS

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 > 312 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)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.9.5	------------------------NOTES-------------------- 1. Only required to be performed when tensioning the reactor vessel head bolting studs. 2. The reactor vessel head bolts may be partially tensioned (four sequences of the seating pass) provided the studs and flange materials are > 70°F. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	30 minutes
SR 3.4.9.6	------------------------NOTE---------------------- Not required to be performed until 30 minutes after RCS temperature ≤ 85°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	30 minutes
SR 3.4.9.7	------------------------NOTE---------------------- Not required to be performed until 12 hours after RCS temperature ≤ 100°F in MODE 4. --- Verify reactor vessel flange and head flange temperatures are > 83°F.	12 hours



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

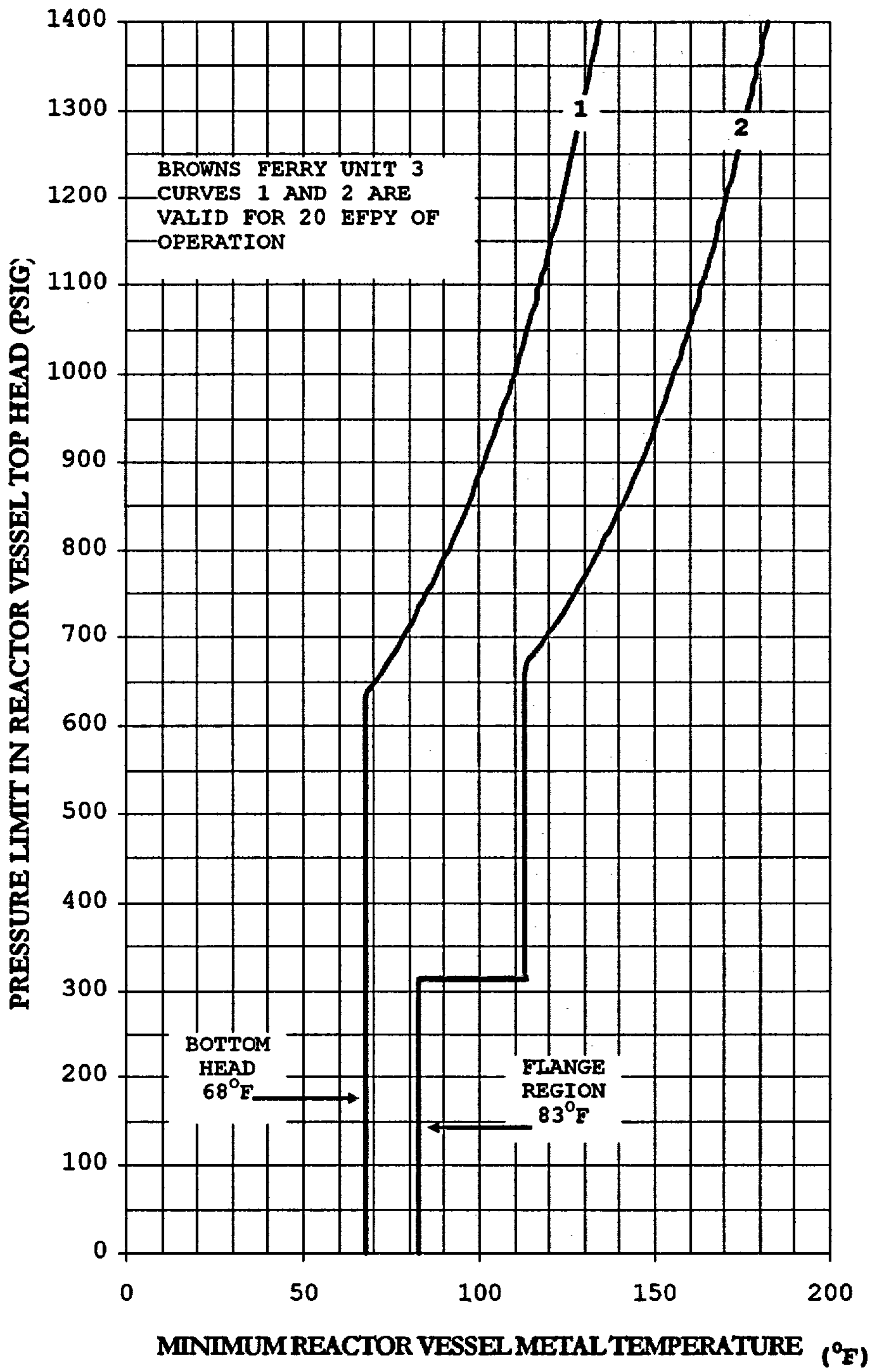
Curve No. 2
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

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 20 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



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

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

<u>Notes</u>
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 20 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

ENCLOSURE 4

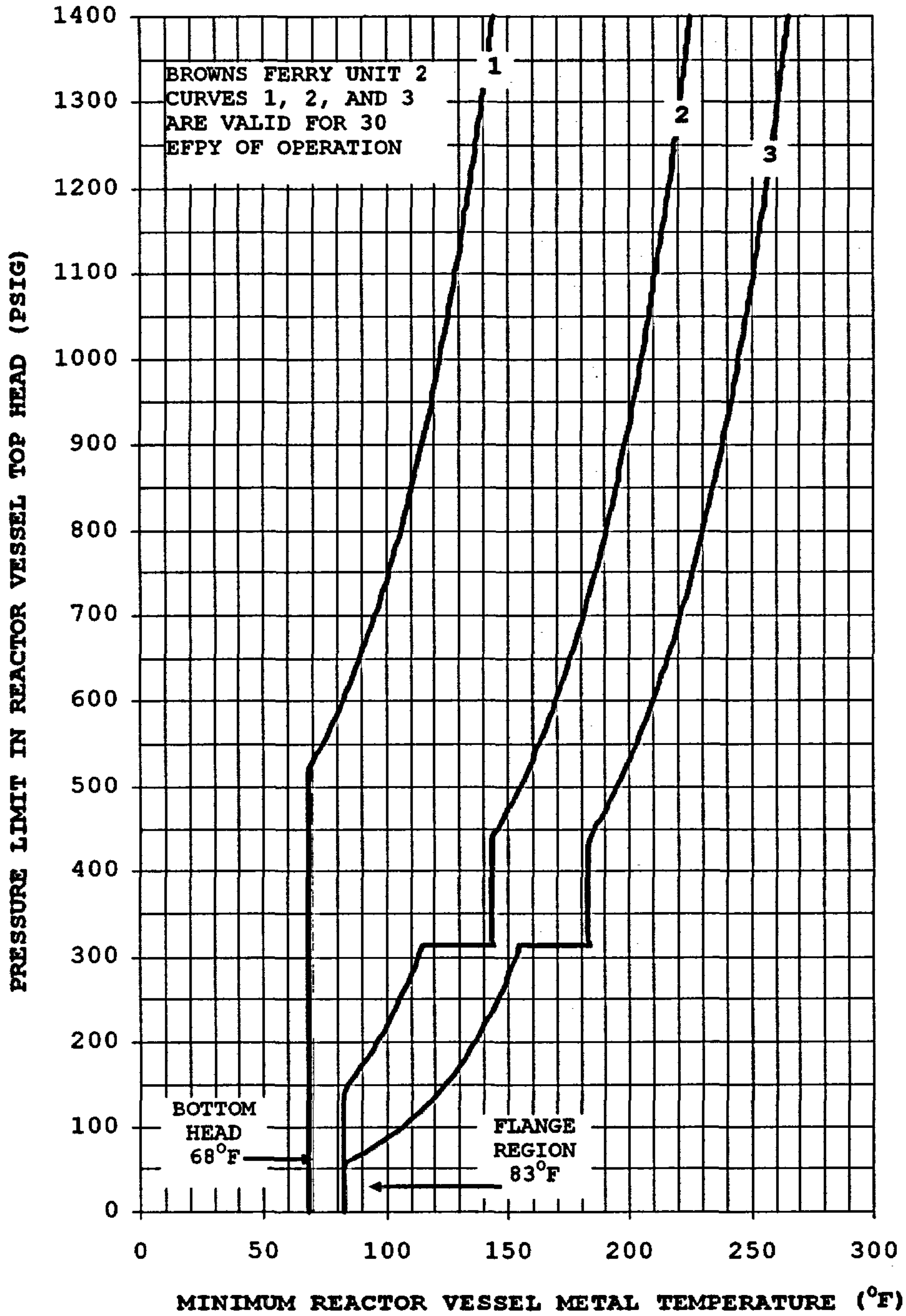
TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
Units 2 and 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441
UNIT 2 30 EFPY AND UNIT 3 28 EFPY FIGURES

The following pages contain the P-T curves for:

Unit 2	30 EFPY	Figure 3.4.9-1 Pressure/Temperature Limits for Mechanical Heatup, Cooldown following Shutdown, and Reactor Critical Operations
Unit 2	30 EFPY	Figure 3.4.9-2 Pressure/Temperature Limits for Reactor In-Service Leak and Hydrostatic Testing
Unit 3	28 EFPY	Figure 3.4.9-1 Pressure/Temperature Limits for Mechanical Heatup, Cooldown following Shutdown, and Reactor Critical Operations
Unit 3	28 EFPY	Figure 3.4.9-2 Pressure/Temperature Limits for Reactor In-Service Leak and Hydrostatic Testing

These pages are submitted for NRC review and approval, however, they will not be placed into the BFN TS at this time. As Unit 2 approaches 23 EFPY, and as Unit 3 approaches 20 EFPY, TVA will replace the TS figures shown in Enclosure 3 above with these figures.



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

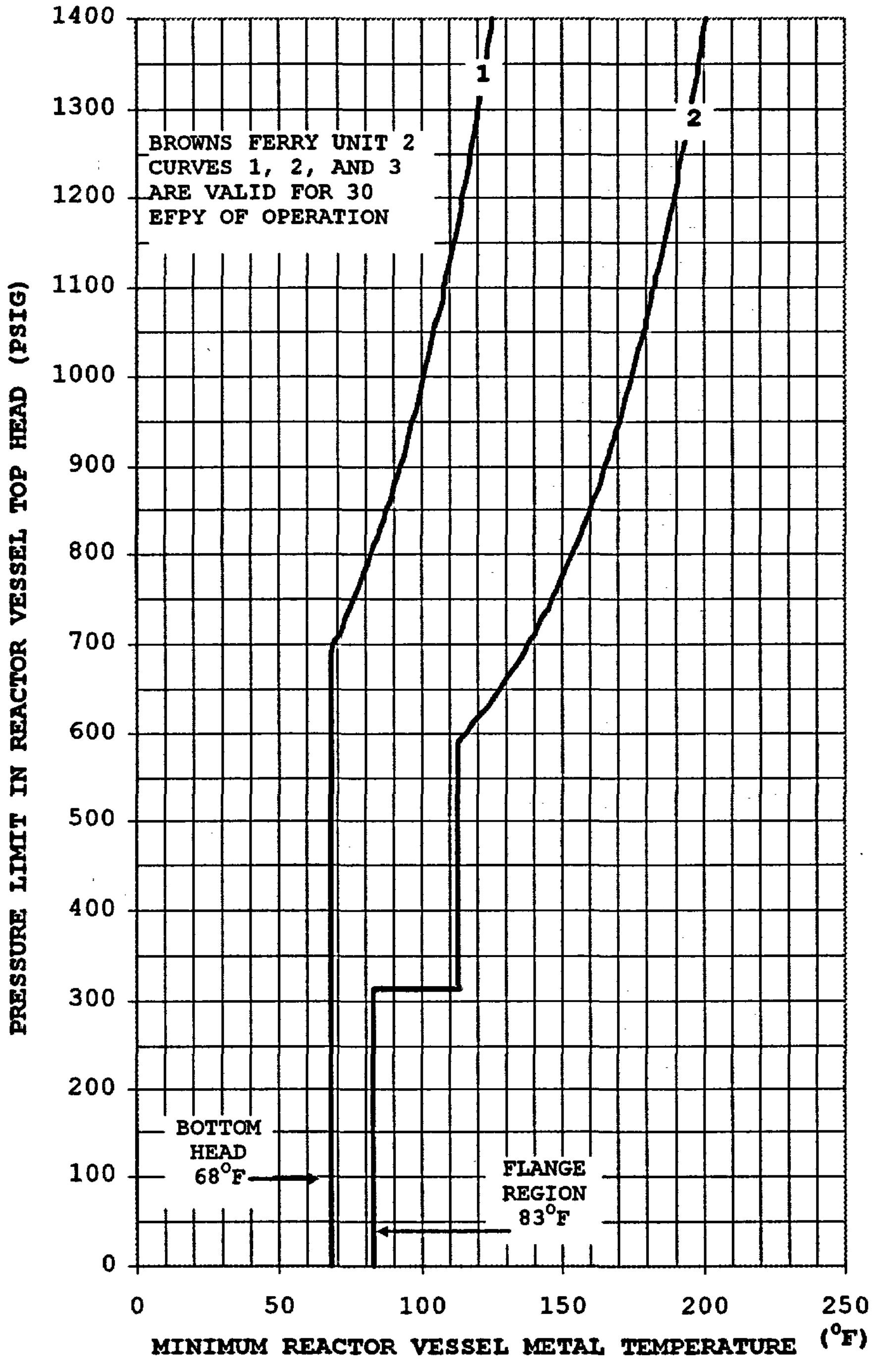
<u>Curve No. 2</u>
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

<u>Curve No. 3</u>
Minimum temperature for core operation (criticality).

<u>Notes</u>
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 30 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



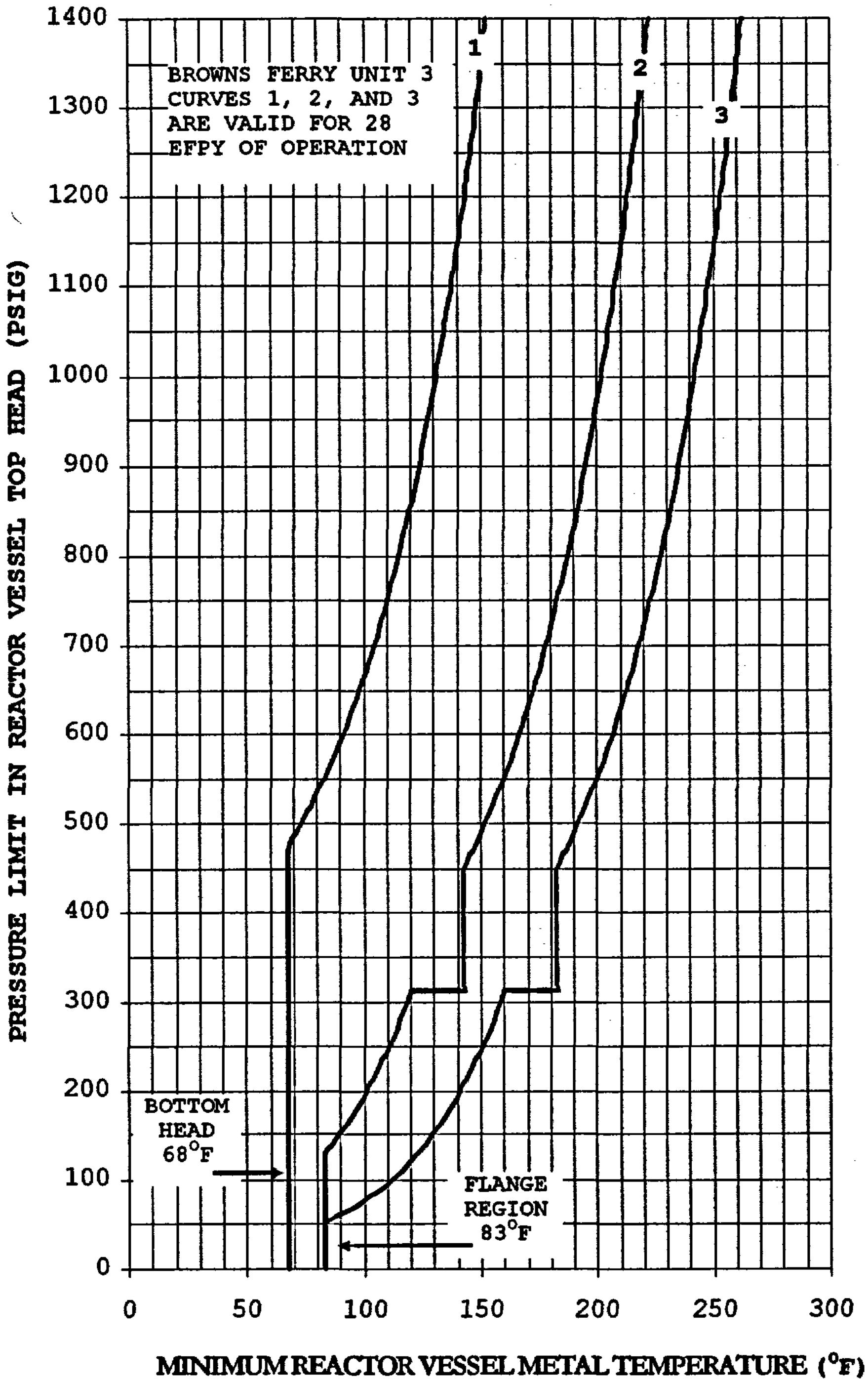
Curve No. 1
Minimum temperature for bottom head during in-service leak or hydrostatic testing.

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 30 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



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

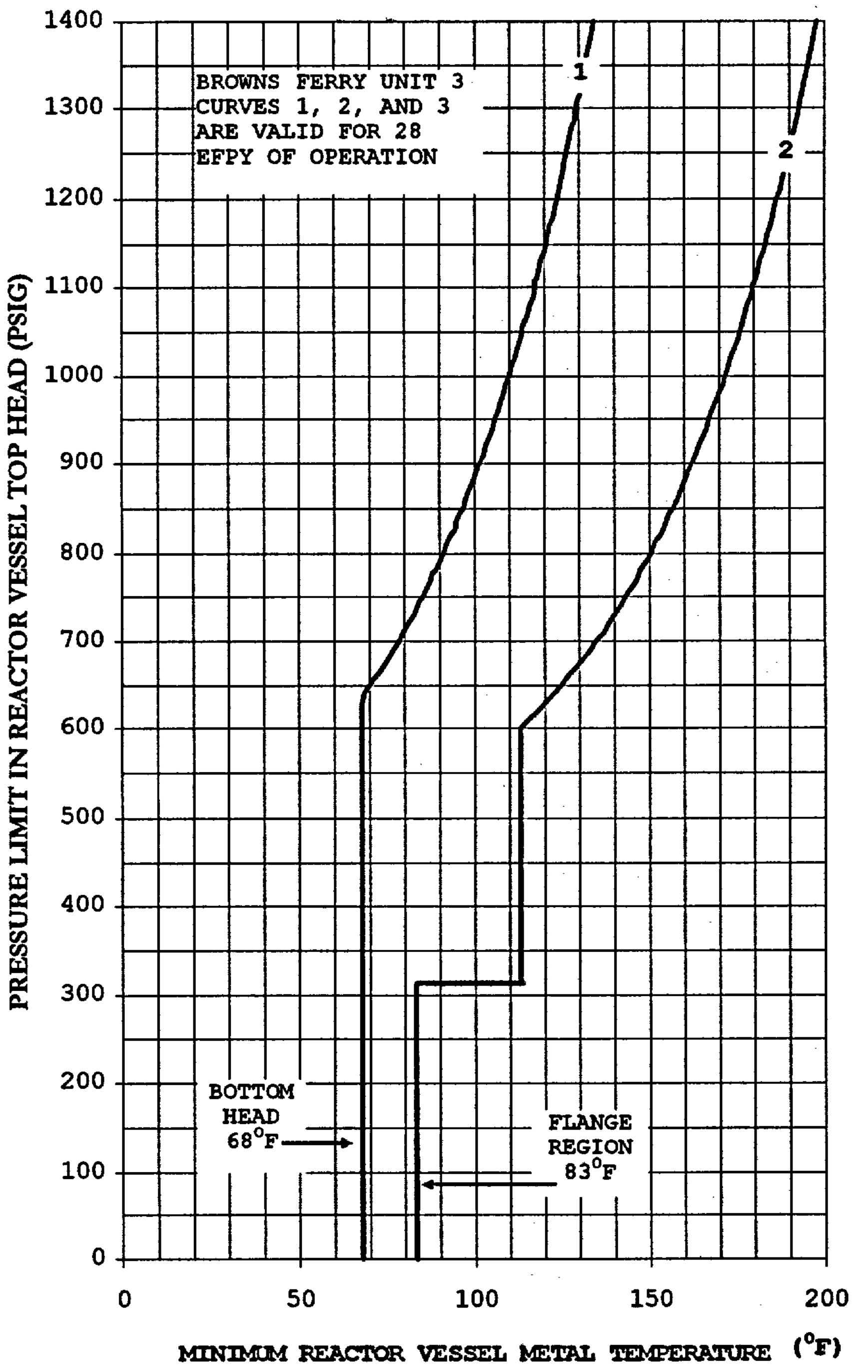
<u>Curve No. 2</u>
Minimum temperature for upper RPV and beltline during mechanical heatup or cooldown following nuclear shutdown.

<u>Curve No. 3</u>
Minimum temperature for core operation (criticality).

<u>Notes</u>
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 28 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 28 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

ENCLOSURE 5

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
Units 2 and 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441

Proprietary Supporting Information

See attached files:

GE-NE-0000-0013-3193-01 - Unit 2
GE-NE-0000-0013-3193-02 - Unit 3

These are the full reports by GE Nuclear Energy which detail the development of the P-T curves being submitted for approval.

These reports are GE proprietary information. The affidavit so stating the proprietary nature of these reports is included as the first page behind the cover sheet of each respective report.

ENCLOSURE 6

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
Units 2 and 3

PROPOSED TECHNICAL SPECIFICATIONS (TS) CHANGE TS-441

Non-Proprietary Supporting Information

See attached files:

GE-NE-0000-0013-3193-01a - Unit 2
GE-NE-0000-0013-3193-02a - Unit 3

These reports are edited, non-proprietary versions of the full reports which are provided in Enclosure 5.