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

CNL-16-165

October 31, 2016

10 CFR 50.90

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 34, Revised Proposed License Conditions and Technical Specification Changes**

References:

1. Letter from TVA to NRC, CNL-15-169, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU)," dated September 21, 2015 (ML15282A152)

2. Letter from TVA to NRC, CNL-16-109, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 23, Miscellaneous Updates," dated July 13, 2016 (ML16195A510)

3. Letter from TVA to NRC, CNL-15-224, "Update to License Amendment Request to Adopt NFPA 805 Performance- Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants for the Browns Ferry Nuclear Plant, Units 1, 2, and 3 (TAC Nos. MF1185, MF1186, and MF1187) - Revised Implementation Item 49," dated October 20, 2015 (ML15293A527)

By the Reference 1 letter, Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for the Extended Power Uprate (EPU) of Browns Ferry Nuclear Plant (BFN) Units 1, 2 and 3. The proposed License Amendment Request (LAR) modifies the renewed operating licenses to increase the maximum authorized core thermal power level from the current licensed thermal power of 3458 megawatts to 3952 megawatts.

The Reference 1 and Reference 2 letters provided, in part, proposed changes to License Conditions and Technical Specifications. During the review of the BFN EPU LAR, the NRC identified the need for changes to the proposed License Conditions and Technical Specifications. Enclosure 1 of this letter provides a supplement to the BFN EPU LAR Evaluation of Proposed Changes. The BFN EPU LAR Evaluation of Proposed Changes is revised to reflect the proposed changes to License Conditions and Technical Specifications resulting from NRC review. Enclosure 1 of this letter supersedes and replaces the enclosure entitled, "Evaluation of Proposed Changes" of the BFN EPU LAR (References 1 and 2), dated September 21, 2015, and July 13, 2016, respectively.

Enclosure 2 of this letter provides a markup of proposed Transition License Condition 3 of License Conditions 2.C.(13), 2.C.(14), and 2.C.(7), for BFN Units 1, 2, and 3, respectively; proposed License Conditions 2.C.(18) for BFN Units 1 and 2, and 2.C.(14) for BFN Unit 3; proposed Technical Specification (TS) 4.3.1, "Fuel Storage, Criticality;" and proposed TS 5.5.14, "Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program." Enclosure 3 of this letter provides a retype of the proposed License Conditions and Technical Specifications included in Enclosure 2 of this letter. Enclosures 2 and 3 of this letter supplement the markup and the retype of affected Renewed Operating License and Technical Specifications pages provided in Attachments 2 and 3, respectively, of the BFN EPU LAR (Reference 1).

Enclosure 4 of this letter provides an update to Table S-3 Implementation Item 49 of TVA letter CNL-15-224, dated October 20, 2015 (Reference 3). Table S-3 is incorporated by reference in current License Conditions 2.C.(13), 2.C.(14), and 2.C.(7), Transition License Condition 3, for BFN Units 1, 2, and 3, respectively.

TVA has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in the Reference 1 letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the supplemental information in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed license amendment. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Alabama State Department of Public Health.

The BFN Plant Operations Review Committee and the TVA Nuclear Safety Review Board have reviewed the enclosed proposed changes and determined that operation of BFN in accordance with the proposed changes will not endanger the health and safety of the public.

There are no new regulatory commitments associated with this submittal. If there are any questions or if additional information is needed, please contact Edward D. Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31st day of October 2016.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. Supplement to BFN EPU LAR, Evaluation of Proposed Changes
2. Supplement to BFN EPU LAR, Attachment 2, Proposed Technical Specification Changes (Markups)
3. Supplement to BFN EPU LAR, Attachment 3, Retyped Proposed Technical Specification Changes
4. Update to Table S-3 Implementation Item 49 of TVA letter CNL-15-224, dated October 20, 2015

cc:

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
State Health Officer, Alabama Department of Public Health

ENCLOSURE 1

Supplement to BFN EPU LAR, Evaluation of Proposed Changes

Enclosure 1

Browns Ferry Nuclear Plant Units 1, 2, and 3

Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68

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

License Amendment Request TS-505 – Extended Power Uprate

EVALUATION OF PROPOSED CHANGES

TABLE OF CONTENTS

SUBJECT: Extended Power Uprate

1.0 SUMMARY DESCRIPTION

The Browns Ferry Nuclear Power Plants (BFN) Units 1, 2, and 3 Renewed Operating Licenses (OLs) specify the Maximum Power Level at which BFN Units 1, 2, and 3 may be operated. The proposed amendment increases the Maximum Power Level authorized from 3458 megawatts thermal (MWt) to 3952 MWt. This amendment request includes revision of the OL and Technical Specifications (TS) to support the increased power level. The new Maximum Power represents an increase of approximately 20% above the original rated thermal power (RTP) of 3293 MWt and an increase of approximately 14% above the Current Licensed Thermal Power (CLTP) level of 3458 MWt. The CLTP level for BFN Unit 1 was approved on March 6, 2007 by Amendment No. 269 (Reference 1). The CLTP level for BFN Units 2 and 3 were approved on September 8, 1998, by Amendment Nos. 254 and 214, respectively (Reference 2).

2.0 DETAILED DESCRIPTION

2.1 Power Uprate Safety Analysis Report

NEDC-33860P, "Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate" (also called the Power Uprate Safety Analysis Report or PUSAR) is provided in Attachment 6 (proprietary version) and Attachment 7 (non-proprietary version) of this submittal.

The GE-Hitachi Nuclear Energy Americas LLC (GEH) licensing topical report NEDC-33004P-A, "Constant Pressure Power Uprate," Revision 4, dated July 2003 (Reference 3), hereafter referred to as the CLTR, provides an NRC-accepted approach for performing constant pressure power uprates (CPPU). The CPPU approach has been used as the basis for multiple power uprate license amendment requests submitted to and approved by the NRC. As the name suggests, the CPPU approach maintains a plant's current maximum operating reactor pressure. The constant pressure constraint along with other required limitations and restrictions discussed in the CLTR, allows a simplified approach to power uprate analyses and evaluations.

The evaluation methods and conclusions of the CLTR were approved for GE fuel up to and including GE14 fuel assemblies. Because BFN uses a mix of fuel types, the CLTR is not applicable for the fuel design-dependent topics and the associated analyses performed in support of the generic disposition in the CLTR are not applicable. Therefore, for fuel-dependent topics, the PUSAR follows the NRC-approved generic content for BWR extended power uprate (EPU) licensing reports documented in NEDC-32424P-A, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate" (Reference 4), which is commonly called "ELTR1." ELTR1 provides the process for evaluating safety issues that are plant-specific. For issues that are evaluated generically, the PUSAR follows the NRC-approved generic evaluations in NEDC-32523P-A, "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate" (Reference 5), which is commonly called the "ELTR2."

The Office of Nuclear Reactor Regulation document, "Review Standard for Extended Power Uprates," RS-001, dated December 2003 (Reference 6), provides guidance to the NRC Staff when performing reviews of EPU applications. The review standard

was developed to enhance the consistency, quality, and completeness of the staff's reviews and to inform licensees of the guidance documents the Staff would use when reviewing EPU applications.

PUSAR Section 2, "Safety Evaluation," follows the format and guidance delineated in RS-001 (Reference 6), Section 3.2, to the extent that the review standard is consistent with the BFN design basis. To facilitate the NRC staff's review of this application, Attachment 48 provides a redline-strikeout mark-up of the matrices contained in RS-001 to identify differences between the review standard and the BFN design bases. Attachment 49 provides a re-type of the RS-001 safety evaluation template.

The PUSAR, as supplemented by ANP-3403P, "Fuel Uprate Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate," hereafter referred to as the FUSAR, is provided in Attachment 8 (proprietary version) and Attachment 9 (non-proprietary version) of this submittal, provides an integrated summary of the results of the safety analyses and evaluations performed in accordance with the CLTR, ELTR1, and ELTR2. The FUSAR supports operation of BFN Units 1, 2, and 3 at EPU conditions with AREVA's ATRIUM 10XM fuel.

These analyses and evaluations support the proposed increase to the maximum power level at BFN to 3952 MWt. These safety analyses also support elimination of the reliance on Containment Accident Pressure (CAP) credit in demonstrating adequate Net Positive Suction Head (NPSH) for the Emergency Core Cooling System (ECCS) pumps.

In developing the PUSAR, the Tennessee Valley Authority (TVA) identified certain evaluations that, due to size, level of detail, and/or subject matter, were more appropriately broken out as separate Attachments to this submittal. These areas include the Steam Dryer Analysis Report (Attachment 40, proprietary version, and Attachment 41, non-proprietary version), Transmission Stability Evaluation (Attachment 43), the Probabilistic Risk Assessment (Attachment 44), the Flow-Induced Vibration Analysis and Monitoring Program (Attachment 45), and the Startup Test Plan (Attachment 46). These evaluations support the appropriate PUSAR Technical Evaluations.

2.2 Fuel Uprate Safety Analysis Report for Browns Ferry Units 1, 2, and 3, and fuel related reports

The FUSAR (ANP-3403) is provided in Attachment 8 (proprietary version) and Attachment 9 (non-proprietary version).

The fuel-related reports, proprietary and non-proprietary versions, where applicable, included in Attachments 10 through 38 are as follows:

- ANP-3377, Browns Ferry Units 1, 2, and 3 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel (EPU)

- ANP-3378, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel (EPU)

- ANP-3384, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10 Fuel (EPU)
- ANP-3342, Browns Ferry EPU (120% OLTP) Equilibrium Fuel Cycle Design
- ANP-3372, Browns Ferry Unit 3 Cycle 19 EPU (120% OLTP) LAR Reference Fuel Cycle Design
- ANP-3404, Browns Ferry Unit 3 Cycle 19 Representative Reload Analysis at Extended Power Uprate
- ANP-3343, Nuclear Fuel Design Report Browns Ferry EPU (120% OLTP) Equilibrium Cycle ATRIUM 10XM Fuel
- ANP-3386, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10XM Fuel Assemblies
- ANP-3385, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10 Fuel Assemblies
- ANP-3388, Fuel Rod Thermal-Mechanical Evaluation for Browns Ferry Extended Power Uprate
- ANP-3327, Evaluation of AREVA Fuel Thermal-Hydraulic Performance for Browns Ferry at EPU
- FS1-0019629/30, Browns Ferry Unit 3 Cycle 19 MCPR Safety Limit Analysis With SAFLIM3D Methodology
- ANP-2860 Revision 2, Supplement 2, Browns Ferry Unit 1 – Summary of Responses to Request for Additional Information, Extension for Use of ATRIUM 10XM Fuel for Extended Power Uprate
- ANP-2637, Boiling Water Reactor Licensing Methodology Compendium
- ANP-3409, Fuel-Related Emergent Regulatory Issues

The FUSAR and the fuel related reports provide summaries of the results of the analyses addressing the effect of operation of BFN Units 1, 2, and 3 at EPU conditions with ATRIUM 10XM fuel.

2.3 Renewed Operating License and Technical Specifications

The following OL and TS sections, and associated TS Bases, are affected by the proposed EPU for the three BFN Units, except as noted:

- Maximum Power Level (Renewed Operating License Section 2.C.(1))
- Potential Adverse Flow Effects (Renewed Operating License Section 2.C(18) for Units 1 and 2, and Section 2.C(14) for Unit 3)

- Definitions - Rated Thermal Power (RTP) (TS 1.1)
- Reactor Core Safety Limits (TS 2.1.1)
- Standby Liquid Control (SLC) System (TS 3.1.7)
- Average Planar Linear Heat Generation Rate (APLHGR) (TS 3.2.1)
- Minimum Critical Power Ratio (MCPR) (TS 3.2.2)
- Linear Heat Generation Rate (LHGR) (TS 3.2.3)
- Reactor Protection System (RPS) Instrumentation (TS 3.3.1.1)
- Feedwater and Main Turbine High Water Level Trip Instrumentation (TS 3.3.2.2)
- End of Cycle Recirculation Pump Trip (EOC-RPT) Instrumentation (TS 3.3.4.1)
- Jet Pumps (TS 3.4.2)
- Residual Heat Removal Service Water (RHRSW) System and Ultimate Heat Sink (UHS) (TS 3.7.1) [BFN Units 2 and 3 only]
- Emergency Equipment Cooling Water (EECW) System and Ultimate Heat Sink (UHS) (TS 3.7.2) [BFN Units 2 and 3 only]
- Main Turbine Bypass System (TS 3.7.5)
- Primary Containment Leakage Rate Testing Program (TS 5.5.12)

Additional changes to TS sections, resulting from NRC reviews, are as follows:

- Fuel Storage, Criticality (TS 4.3.1)
- Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program (TS 5.5.14)

Section 3.1 of this Enclosure provides the details of the above changes along with the associated technical justification. Attachment 2 contains the proposed TS Change Markups. Attachment 3 contains the retyped proposed TS changes. Associated proposed changes to the TS Bases are provided for information only in Attachment 4 (markups) and Attachment 5 (retyped pages). In addition, some editorial changes, such as removal of outdated footnotes and errant punctuation marks, were also made, as reflected in Attachments 2 and 3, but are not specifically described in this Enclosure. These editorial changes are administrative in nature and do not involve technical changes to the TS.

2.4 TS Containing Percentage of Rated Thermal Power That Are Not Affected

Many of the TS listed above contain criteria or requirements expressed in terms of percent rated thermal power (% RTP) that are re-scaled or otherwise adjusted for the EPU. However, there are several other TS with such criteria that do not require

revision to support EPU. The CLTR, Section 11.1, discussed this situation of the TSs expressed in terms of % RTP that may not require a change based on EPU. To ensure clarity, the CLTR provided Table 11-1, which included all % RTP TS. Each TS was dispositioned as to whether it required a change or not. Similarly, to avoid any misunderstanding, TVA provides below the BFN-specific TSs that are expressed in terms of % RTP and are not changing. A brief explanation as to why a revision is unnecessary is included.

1. Control Rod Operability (TS 3.1.3)

   The current TS 3.1.3 Condition D includes a note stating the Condition is not applicable when thermal power is greater than 10% RTP. The stated % RTP is conservatively maintained at the same % RTP as the CLTP. The 10% RTP power level is the power level below which the control rod drop accident (CRDA) analyses assume the reactor operator follows prescribed rod withdrawal sequences (i.e., complies with Banked Position Withdrawal Sequence (BPWS) requirements).

   The BPWS requires control rods to be moved in groups, with all control rods assigned to a specific group within specified banked positions. The banked positions are established to minimize the maximum incremental control rod worth. Analyses demonstrate that the 280 cal/gm fuel damage limit will not be violated during a CRDA while following the BPWS mode of operation.

   Maintaining BPWS requirements in effect until 10% RTP of the EPU power level will result in a larger range in terms of absolute power when BPWS requirements apply. Therefore, not revising the TS 3.1.3 Condition D note is conservative for EPU.

2. Control Rod Scram Times (TS 3.1.4)

   Current Surveillance Requirement (SR) 3.1.4.1 and SR 3.1.4.4 Frequencies require verification that control rod scram times are within applicable limits prior to exceeding 40% RTP. The stated % RTP does not change. The 40% RTP provides a reasonable time to complete the scram time testing following a shutdown. As such, this is a timing consideration to allow for the testing to be completed and does not affect the operation or operability of the control rods. Thus, it is acceptable to maintain the current 40% RTP.

3. Rod Pattern Control (TS 3.1.6)

   The applicability of current TS 3.1.6 requirements for BPWS is MODES 1 and 2 with THERMAL POWER ≤ 10% RTP. The stated % RTP is conservatively maintained at the same % RTP as the CLTP. The 10% RTP power level is the power level below which the CRDA analyses assume the reactor operator follows prescribed rod withdrawal sequences (i.e., complies with BPWS requirements).

   The BPWS requires control rods to be moved in groups, with all control rods assigned to a specific group within specified banked positions. The banked positions are established to minimize the maximum incremental control rod worth. Analyses demonstrate that the 280 cal/gm fuel damage limit will not be violated during a CRDA while following the BPWS mode of operation.

Therefore, maintaining the TS 3.1.6 applicability of MODES 1 and 2 with THERMAL POWER ≤ 10% RTP of the EPU power level will result in a larger range in terms of absolute power when BPWS requirements apply and will continue to prevent exceeding the 280 cal/gm fuel design limit during a CRDA.

4. Reactor Protection System (RPS) Instrumentation (TS 3.3.1.1)

   Current Table 3.3.1.1-1, Function 2.b (APRM - Flow Biased Simulated Thermal Power - High) and Function 2.c (APRM - Neutron Flux - High) provide an allowable value of ≤ 120% RTP. Although the APRM – Flow Biased Simulated Thermal Power – High setpoint is changed, the clamped high value remains the same in terms of % RTP.

   Both Function 2.b and Function 2.c will perform the same under EPU as CLTP to the high neutron flux trip setpoint clamp setting. The APRM - Flow Biased Simulated Thermal Power - High trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) but is clamped at an upper limit that is slightly lower than or equal to the fixed APRM Neutron Flux – High function allowable value. Because of the increase in RTP from CLTP to EPU, the clamped high value setting is re-scaled to ≤ 120% of the uprated RTP, consistent with the assumptions used in the revised safety analyses. (Refer to PUSAR Section 2.4.1.3.)

5. Control Rod Block Instrumentation (TS 3.3.2.1)

   Current Table 3.3.2.1-1 Function 2, "Rod Worth Minimizer," (SR 3.3.2.1.2, SR 3.3.2.1.3, SR 3.3.2.1.5, and Table 3.3.2.1-1 note (c)) is required to be Applicable, in part, in MODES 1 and 2 with THERMAL POWER ≤ 10% RTP. The stated % RTP is conservatively maintained at the same % RTP as the CLTP. The 10% RTP power level is the power level below which the CRDA analyses assume the reactor operator follows prescribed rod withdrawal sequences (i.e., complies with BPWS requirements).

   The BPWS requires control rods to be moved in groups, with all control rods assigned to a specific group within specified banked positions. The banked positions are established to minimize the maximum incremental control rod worth. Analyses demonstrate that the 280 cal/gm fuel damage limit will not be violated during a CRDA while following the BPWS mode of operation. The Rod Worth Minimizer (RWM) functions to enforce the BPWS requirements.

   Therefore, maintaining the TS 3.3.2.1 Table 3.3.2.1-1 Function 2 (SR 3.3.2.1.2, SR 3.3.2.1.3, SR 3.3.2.1.5, and Table 3.3.2.1-1 note (c)) Applicability of MODES 1 and 2 with THERMAL POWER ≤ 10% RTP of the EPU power level will result in a larger range in terms of absolute power when BPWS and RWM requirements apply and will continue to prevent exceeding the 280 cal/gm fuel damage limit during a CRDA.

   SR 3.3.2.1.8 and Notes (a), (b), (f), (g), and (h) of Table 3.3.2.1-1 Analytical Limit (AL) associated with the Analytical Value power levels for the various ranges of Rod Block Monitor operability are unchanged in terms of percent power for EPU,

thus no setpoint change is required. The power-dependent MCPR multiplier at each AL are verified on a cycle specific basis in order to determine if the multiplier is bounding.

6. Drywell-to-Suppression Chamber Differential Pressure (TS 3.6.2.6)

   The current Limiting Condition for Operation (LCO), APPLICABILITY, and REQUIRED ACTIONS for TS 3.6.2.6 include reference to 15% RTP. The applicability for TS LCO 3.6.2.6 is "MODE 1 during the time period from 24 hours after Thermal Power is > 15% RTP following startup, to 24 hours prior to reducing Thermal Power to < 15% RTP prior to the next scheduled reactor shutdown." In accordance with CLTR Table 11-1 regarding the drywell-to-suppression chamber differential pressure TS, this value does not change for EPU.

   The drywell-to-suppression chamber differential pressure is an assumption in the containment analysis. The drywell-to-suppression chamber differential pressure establishes a MODE 1 operating condition with the drywell at a higher pressure than the suppression chamber. During a postulated design basis loss-of-coolant accident (LOCA), the increasing drywell pressure will discharge mass and energy, including non-condensables, into the wetwell vent header and downcomers. The drywell-to-suppression chamber differential pressure reduces the resultant hydrodynamic load on the suppression chamber during the LOCA blowdown.

   Although the absolute thermal power increases for EPU at 15% RTP, the effects on containment hydrodynamic loads due to a LOCA have been evaluated and remain within specified limits. (Refer to PUSAR Section 2.6.1.2.)

7. Primary Containment Oxygen Concentration (TS 3.6.3.2)

   The Applicability of current TS LCO 3.6.3.2 is MODE 1 during the time period from 24 hours after Thermal Power is greater than 15% RTP following startup, to 24 hours prior to reducing Thermal Power to less than 15% RTP prior to the next scheduled reactor shutdown. The TS LCO 3.6.3.2 Applicability value of 15% RTP is a historical value for requiring containment inerting. The current TS Bases do not reference analyses supporting the 15% power level. Maintaining this LCO power level value at 15% EPU RTP from the current 15% RTP results in an insignificant change in the hydrogen source due to a LOCA and the potential for a fire or explosion is unchanged at EPU conditions. In accordance with CLTR Table 11-1 regarding the applicability of the primary containment oxygen concentration TS, this value does not change for EPU.

2.5 TS Containing Changes That Have Already Been Made

This section describes EPU-related TS changes that have previously been NRC-approved for at least one BFN unit. This information is provided to support NRC staff review of the effects the proposed EPU may have in related areas.

1. Standby Liquid Control (SLC) System (TS 3.1.7)

   Several changes to TS 3.1.7 support EPU:

   a. For BFN Unit 1 only, in SR 3.1.7.5, the value for the minimum quantity of Boron-10 in the SLC System solution tank has changed to greater than or equal to 203 pounds. This change incorporated EPU conditions and was approved by the NRC on March 6, 2007, by Amendment 269, "Five Percent Uprate," (Reference 1) to the Renewed Facility Operating License for BFN Unit 1. Proposed changes (described in Section 3.1 below) to the BFN Unit 2 and BFN Unit 3 Technical Specifications will make TS 3.1.7 similar for all three BFN units.

   b. The borated solution volume in the storage tank must be maintained for reactivity control and Post-LOCA suppression pool pH control. The tank volume requirement for reactivity control is encompassed by the requirement for post-LOCA pH control. The amount of available sodium pentaborate required in SR 3.1.7.1 (greater than or equal to 4000 gallons) does not change for EPU. The volumes provided in the calculation for SLC System Boron-10 requirements demonstrate that EPU requirements are bounded by the volumes calculated for the Alternative Source Term (AST). The AST requirements, at EPU values, were approved by the NRC for BFN Units 1, 2, and 3 on September 27, 2004 (Reference 8). The analyses performed to support these changes were performed at EPU conditions.

   c. Other TS changes were approved as part of the AST license change. These include SLC parameters for meeting Anticipated Transients Without Scram (ATWS) concerns. The other changes to the SLC System were:

      i. Changed the SLC Mode of Applicability to require SLC to be operable in Mode 3. Commensurate with the change to the SLC Mode of Applicability, a Required Action and associated Completion Time was added to place the reactor in Mode 4 within 36 hours if the Required Action and associated Completion Time of Actions A or B are not met.

      ii. SR 3.1.7.1 was changed to increase the available volume of sodium pentaborate solution (SPB) from greater than or equal to 3007 gallons to greater than or equal to 4000 gallons.

      iii. SR 3.1.7.3 was added to perform a verification that the SPB concentration is greater than or equal to 8.0% by weight every 31 days and once within 24 hours after water or boron is added to the solution.

2. Primary Containment Isolation Valves (PCIVs) (TS 3.6.1.3)

   Changes to the main steam isolation valve (MSIV) leakage rate limits (TS SR 3.6.1.3.10) were previously approved for BFN Units 2 and 3 by Amendment Nos. 263 and 223, respectively, dated March 14, 2000 (Reference 15). A similar change for BFN Unit 1 was approved by Amendment No. 261 on September 27, 2006 (Reference 16). The radiological consequences based on the MSIV leakage limits under EPU conditions and the acceptability of the alternate leakage treatment (ALT) system for BFN Units 1, 2, and 3 were

previously approved by the NRC staff as documented in the safety evaluation for Amendment Nos. 251, 290, and 249, respectively, (full-scope implementation of AST), dated September 27, 2004 (Reference 8).

3. RCS Pressure and Temperature (P/T) Limits (TS 3.4.9)

   The Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits for BFN Units 1, 2, and 3 have been developed for EPU conditions and have been submitted to the NRC for approval as follows:

   a. The BFN Unit 1 change was submitted to the NRC on December 18, 2013 (Reference 10) and approved in Amendment No. 287 on February 2, 2015 (Reference 13).

   b. The BFN Unit 2 change was submitted to the NRC on June 19, 2014 (Reference 11) and approved in Amendment No. 314 on June 2, 2015 (Reference 17).

   c. The BFN Unit 3 change was submitted to the NRC on January 27, 2015, (Reference 12) and approved in Amendment No. 278 on January 7, 2016 (Reference 21).

2.6 Elimination of Containment Accident Pressure Credit

TVA is eliminating the need to rely on containment accident pressure (CAP) for specific event sequences associated with the proposed EPU. The elimination of the need for CAP credit is consistent with guidance contained in NRC Regulatory Guide (RG) 1.82, "Water Source for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident" (Reference 7). RG 1.82 recommends minimizing reliance on CAP credit to demonstrate adequate pump net positive suction head (NPSH) margins to the extent possible. Therefore, TVA has pursued elimination of reliance on CAP credit for BFN's EPU. The elimination of CAP credit is accomplished through plant modifications, analysis methodology changes, and revised safety analyses, and therefore, is integrated into the EPU technical basis. Refer to PUSAR Section 2.6.5.2 and LAR Attachment 39 for additional information regarding the elimination of CAP credit at BFN.

2.7 Plant Modifications

TVA is also making various physical plant changes required to support EPU conditions. Some modifications are necessary to support efficient electrical output of the units to maximize the benefits from the increase in RTP. Other modifications are necessary to support or compensate for changes in analysis using plant-specific EPU parameters. These modifications were evaluated for impact to the Technical Specifications and Bases, as noted by proposed changes in Section 2.0 above and the technical evaluation in Section 3.0 of this attachment. The Updated Final Safety Analysis Report (UFSAR) will be updated, as required when the EPU application is approved. The detailed description of the plant changes are addressed in Attachment 47 of this amendment request. The steam dryer is also being replaced. Technical information regarding the Replacement Steam Dryer (RSD) is located in Attachments 40 (proprietary) and 41 (non-proprietary).

2.8 Methodology Changes

Containment Accident Pressure (CAP) Credit Elimination Methodologies

The following changes to analytical assumptions are applied to the EPU analyses for design basis and special events:

1. Rather than using limiting values, nominal (or realistic) values are used in the analysis of special events (beyond design basis events) that include Station Blackout, ATWS and Fire events. This change is discussed in more detail in PUSAR Section 2.6.5.2.

2. Credit is taken for passive heat sinks in the suppression pool temperature response to certain design basis and special events. Although this change in methodology is applicable to the containment analyses, the resultant change in suppression pool temperature response is a key input towards elimination of CAP credit in NPSH analyses. Heat sinks are also credited in minimizing containment pressure

The evaluation of ECCS pump NPSH margin for specified design basis and special events is described in PUSAR Section 2.6.5.2. Additional event-specific details, including the methodologies used to perform the analyses, are provided in the following PUSAR sections:

- 2.3.5 Station Blackout
- 2.5.1.4.2 Fire Event
- 2.6.1.1 Containment Pressure and Temperature Response
- 2.8.5.6.2 Emergency Core Cooling System and Loss-of-Coolant Accidents
- 2.8.5.7 Anticipated Transients Without Scram

3.0 TECHNICAL EVALUATION

3.1 Renewed Operating Licensing and Technical Specification Changes

The following OL and TS Changes are required to support EPU and the associated elimination of reliance on CAP credit in the licensing basis. In addition, all actions that will not be completed prior to EPU power ascension will be contained in license conditions.

1. Renewed Operating License ~~Paragraph~~ Section 2.C(1)

   The proposed change supports an increase in the authorized Maximum Power Level from 3458 MWt to 3952 MWt. The analyses and evaluations presented in the Attachments to this license amendment request support this proposed change.

2. Renewed Operating License ~~Paragraph~~ Section 2.C(18) for Units 1 and 2 and 2.C(14) for Unit 3

   The proposed change provides requirements for monitoring and evaluating potential adverse flow effects as a result of power uprate operation, including verifying the continued structural integrity of the replacement steam dryers. Also, during the first two scheduled refueling outages after reaching EPU conditions, requirements are provided for performing visual inspections of the replacement steam dryers. The change is consistent with license conditions issued for other EPU license amendments. Refer to LAR Attachment 2 for additional information.

3. Definitions (TS 1.1)

   The proposed change revises the definition of RATED THERMAL POWER (RTP) from the current value of 3458 MWt to 3952 MWt. The analyses and evaluations presented in the Attachments to this license amendment request support this request. This change is reflective of the Renewed Operating License change discussed above.

4. Reactor Core Safety Limits (TS 2.1.1)

   The current TS 2.1.1.1 states that thermal power shall be less than or equal to 25% RTP when the reactor steam pressure is less than 785 psig or core flow is less than 10% rated core flow. The proposed change revises the less than or equal to 25% RTP limit to less than or equal to 23% RTP. The revision to the RTP limit is based on the fuel thermal limit monitoring threshold. (Refer to PUSAR Section 2.8.2.1.1.)

   The current TS 2.1.1.2 for Unit 3 states that the Safety Limit Minimum Critical Power Ratio (SLMCPR) shall be greater than or equal to 1.09 for two recirculation loop operation or greater than or equal to 1.11 for single loop operation. A proposed change to the BFN Unit 3 SLMCPR was submitted to the NRC on March 6, 2015 (Reference 19). This proposed change is also reflected in Attachments 2 and 3. The proposed change modifies the TS 2.1.1.2 value of the SLMCPR for two-loop operation to 1.06 and the SLMCPR for single loop operation to 1.08. The revised SLMCPR values reflect a reduction from the current values, supported by the application of the SAFLIM3D methodology previously approved for BFN. In support of the proposed TS change, AREVA has performed a BFN Unit 3 specific evaluation based on a representative Cycle 19 core design to demonstrate that the proposed SLMCPR values are conservative for EPU conditions (Refer to Attachment 32).

5. Standby Liquid Control (SLC) System (TS 3.1.7)

   The following SRs are being revised to support EPU:

   a. The proposed change to TS SR 3.1.7.5 revises the value of the minimum quantity of Boron-10 (B-10) in the SLC System solution tank from 186 pounds to 203 pounds for BFN Units 2 and 3. The requirement for 203 pounds of B-10 reflects the change in the required boron concentration. (Refer to PUSAR Section 2.8.4.5.1.) As previously stated, the BFN Unit 1 change to

the minimum quantity of B-10 (greater than or equal to 203 pounds) in SR 3.1.7.5 was approved by the NRC on March 6, 2007, by Amendment 269, "Five Percent Uprate," (Reference 1) to the Renewed Facility Operating License for BFN Unit 1.

b. The SLC system is required to inject borated water solution into the reactor pressure vessel to control reactor power in the event of an ATWS event in accordance with the requirements of 10 CFR 50.62(c)(4). By meeting the conditions specified in SR 3.1.7.6, the SLC System provides a combination of flow capacity and B-10 content equivalent in control capacity to 86 gpm of 13 weight percent (wt. %) natural sodium pentaborate solution.

The proposed change to TS SR 3.1.7.6 provides a more rapid shutdown of the reactor during an ATWS event and considers the increase in heat generated due to EPU. The reduction in the peak suppression pool temperature for EPU is a result of modified plant parameters in the ATWS safety analysis, including an increase in SLC System B-10 enrichment, an increase in the credited SLC storage tank boron concentration, and an increase in the credited SLC flow rate. As a result, the total integrated heat load added to the suppression pool during an ATWS event is reduced, which provides additional NPSH margin for the credited ECCS pumps.

For EPU, the B-10 enrichment is increased to a nominal 94 atom-percent. However, the equation specified in SR 3.1.7.6 can be satisfied by a lower B-10 enrichment by increasing the other variables (i.e., boron concentration and/or pump flow rate).

For EPU, the equivalency requirement can be demonstrated if the following relationship is satisfied:

$$\frac{(\quad C \quad)(\quad Q \quad)(\quad E \quad)}{(8.7 \text{ wt. \%})(50 \text{ gpm})(94 \text{ atom \%})} \geq 1$$

where,

C = sodium pentaborate solution concentration (wt. %)
Q = pump flow rate (gpm)
E = B-10 enrichment (atom % B-10)

If the result of the above equation is numerically greater than or equal to one, the SLC System is capable of shutting down the reactor with significant margin to the acceptance criteria for suppression pool temperature. (Refer to PUSAR Section 2.8.4.5 for an evaluation of the SLC System for EPU, and PUSAR Section 2.8.5.7 for the ATWS evaluation under EPU conditions.)

6. Average Planar Linear Heat Generation Rate (APLHGR) (TS 3.2.1)

TS 3.2.1 APLHGR Applicability, Required Action B.1, and SR 3.2.1.1 Frequency include requirements associated with a thermal power limit of 25% RTP. The proposed change revises the 25% RTP to 23% RTP. The revision to the % RTP

is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

7. Minimum Critical Power Ratio (MCPR) (TS 3.2.2)

   TS 3.2.2 MCPR Applicability, Required Action B.1 and SR 3.2.2.1 Frequency include requirements associated with a thermal power limit of 25%. The proposed change revises the 25% RTP to 23% RTP. The revision to the % RTP is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

8. Linear Heat Generation Rate (LHGR) (TS 3.2.3)

   TS 3.2.3 LHGR Applicability, Required Action B.1 and SR 3.2.3.1 Frequency include requirements associated with a thermal power limit of 25%. The proposed change revises the 25% RTP to 23% RTP. The revision to the % RTP is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

9. Reactor Protection System (RPS) Instrumentation (TS 3.3.1.1)

   The following Actions and SRs are being revised to support the EPU:

   a. The proposed change revises the RTP level value of TS 3.3.1.1 Required Action E.1 from 30% RTP to 26% RTP for arming the Turbine Stop Valve - Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Functions. Rescaling the % RTP maintains the same absolute thermal power level that was evaluated and approved for CLTP. (Refer to PUSAR Section 2.4.1.3.2 and Table 2.4-1.)

   b. The proposed change revises the Average Power Range Monitor (APRM) channel check RTP thermal monitoring threshold value of TS SR 3.3.1.1.2 and the associated Note from 25% RTP to 23% RTP. The revision to the % RTP is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

   c. The proposed change revises the RTP level value for arming the Turbine Stop Valve - Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Functions in TS SR 3.3.1.1.15 from 30% RTP to 26% RTP . Rescaling the % RTP maintains the same absolute thermal power level that was evaluated and approved for CLTP. (Refer to PUSAR Section 2.4.1.3.2 and Table 2.4-1.)

   d. TS SR 3.3.1.1.17 to the Reactor Protection System (RPS) Instrumentation ensures the OPRM Upscale Function will not be inadvertently bypassed in the region of power and flow operation if thermal hydraulic oscillations occur. Entry into this region is indicated by APRM Simulated Thermal Power ≥ 23% RTP and recirculation drive flow < 60% of rated flow. The proposed change revises the SR RTP level value from 25% RTP to 23% RTP to maintain the same absolute thermal power level that was previously approved for CLTP. The revision to the RTP is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Sections 2.8.2.1.2 and 2.8.3.1.1.)

e. The proposed change revises the Allowable Value of Table 3.3.1.1-1, Function 2.a, APRM Neutron Flux - High (Setdown), from less than or equal to 15% RTP to less than or equal to 13% RTP. Rescaling the % RTP maintains the same absolute thermal power level authorized for CLTP in terms of megawatts thermal. The APRM Neutron Flux - High (Setdown) function is not credited in the accident or transient analysis. (Refer to PUSAR Section 2.4.1.3 and Table 2.4-1.)

f. The proposed change revises the Allowable Value of Table 3.3.1.1-1, Function 2.b, APRM Flow Biased Simulated Thermal Power - High, from ≤ 0.66 W + 66% RTP to ≤ 0.55 W + 65.5% RTP for two loop operation. The proposed change also revises Footnote (c) from [0.66 W + 66% - 0.66 Δ W] RTP to [0.55 W + 65.5% - 0.55 Δ W] RTP for single loop operation. The Allowable Value is based on the proposed changes in power level. The APRM Flow Biased Simulated Thermal Power - High function is not credited in the accident or transient analysis for BFN. The calculated value follows the methodology that the NRC approved by Amendment Nos. 257, 296, and 254 for BFN Units 1, 2, and 3, respectively, dated September 14, 2006. (Reference 9) (Refer to PUSAR Section 2.4.1.3 and Table 2.4-1.)

g. The proposed change revises the Applicable Modes or Other Specified Conditions of Table 3.3.1.1-1, Function 8, Turbine Stop Valve - Closure, from 30% RTP to 26% RTP. Rescaling the % RTP maintains the same absolute thermal power level that was evaluated and approved for CLTP. (Refer to PUSAR Section 2.4.1.3 and Table 2.4-1.)

h. The proposed change revises the Applicable Modes or Other Specified Conditions of Table 3.3.1.1-1, Function 9, Turbine Control Valve Fast Closure, Trip Oil Pressure - Low, from 30% RTP to 26% RTP. Rescaling the % RTP maintains the same absolute thermal power level that was evaluated and approved for CLTP. (Refer to PUSAR Section 2.4.1.3 and Table 2.4-1.)

10. Feedwater and Main Turbine High Water Level Trip Instrumentation (TS 3.3.2.2)

TS 3.3.2.2 Applicability and Required Action C.1 include requirements corresponding to thermal power limits of 25% RTP. The proposed change to LCO 3.3.2.2 revises the 25% RTP to 23% RTP. The revision to the % RTP is based on the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

11. End of Cycle Recirculation Pump Trip (EOC - RTP) Instrumentation (TS 3.3.4.1)

TS 3.3.4.1 Applicability, Required Action C.1, and SR 3.3.4.1.2 include requirements corresponding to thermal power limits of 30% RTP. The proposed change to LCO 3.3.2.2 revises the 30% RTP to 26% RTP. Rescaling the % RTP maintains the same absolute thermal power level that was evaluated and authorized for CLTP. (Refer to PUSAR Section 2.4.1.3 and Table 2.4-1.)

12. Jet Pumps (TS 3.4.2)

TS SR 3.4.2.1, Note 2 states that the surveillance is not required to be performed until 24 hours after > 25% RTP. The 25% RTP in the note is being changed to

23% RTP. The revision to the % RTP is conservative, providing consistency with the other proposed changes from 25% RTP to 23% RTP that are associated with the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

13. Containment Atmosphere Dilution (CAD) System (TS 3.6.3.1)

    Current TS SR 3.6.3.1.1 requires that at least 2500 gallons of liquid nitrogen be stored in each nitrogen storage tank. This volume is being increased to 2615 gallons as a result of the increased production rate of radiolytic gas following a postulated LOCA under EPU conditions. The revised TS value represents the analytical limit assumed in the analysis of the primary containment atmosphere following a postulated LOCA, and does not include allowance for potential nitrogen boil-off and tank level instrumentation inaccuracies. Implementing procedures will include the appropriate margin in tank volume to account for uncertainties. (Refer to FUSAR Section 2.6.4.)

14. Residual Heat Removal Service Water (RHRSW) System and Ultimate Heat Sink (UHS) (TS 3.7.1) [BFN Units 2 and 3 only]

    For BFN Units 2 and 3 only, TS 3.7.1 is being revised to remove requirements for the ultimate heat sink (UHS), which are included in TS 3.7.2. Reference to the UHS is being deleted from TS 3.7.1 and the section title is being changed to "Residual Heat Removal Service Water (RHRSW) System." These changes will make TS 3.7.1 alike for all three BFN units. Specifically:

    a. The page headings for TS 3.7.1 is being changed from "RHRSW System and UHS" to "RHRSW System." TS requirements for the UHS are contained in TS 3.7.2.

    b. TS LCO 3.7.1 is being revised to remove the requirement for the UHS to be OPERABLE in MODES 1, 2, and 3. This requirement is redundant and already included in TS LCO 3.7.2.

    c. TS LCO 3.7.1 ACTION G is being revised to remove the requirement to be in MODE 3 within 12 hours and MODE 4 within 36 hours when the UHS is inoperable. This requirement is redundant and already included in TS LCO 3.7.2 ACTION B.

    d. TS SR 3.7.1.2 and Figure 3.7.1-1 are being deleted because there is no longer a restriction for the UHS average water temperature to be in accordance with the limits specified in Figure 3.7.1-1. When the average water temperature of the UHS is at or below 95°F, there is no longer a need to make any reduction in rated thermal power for the UHS to be OPERABLE. The provisions of TS SR 3.7.1.2 and Figure 3.7.1-1 are not contained in the BFN Unit 1 TS.

    The service water and UHS temperature limit for all three BFN units is specified in TS SR 3.7.2.1 as less than or equal to 95°F. The EPU design basis analyses for design basis events, including the long term primary containment response after a design basis LOCA, assume a UHS temperature equal to 95°F.

The evaluation supporting this change is described in PUSAR Sections 2.5.3.4 and 2.6.5.1, applies to the UHS service water temperature for all three BFN units, and provides the basis for the revised service water temperature limit used in the safety analyses.

15. Emergency Equipment Cooling Water (ECCS) System and Ultimate Heat Sink (UHS) (TS 3.7.2) [BFN Units 2 and 3 only]

    The Note referring to TS SR 3.7.2.1 for additional requirements related to the UHS in the BFN Units 2 and 3 TS is being deleted. This note is being deleted because the UHS requirements in TS 3.7.1 are being deleted. (Refer to PUSAR Section 2.5.3.4.)

16. Main Turbine Bypass System (TS 3.7.5)

    TS 3.7.5 Applicability and Required Action B.1 include requirements corresponding to thermal power limits of 25% RTP. The proposed change revises the 25% RTP to 23% RTP. The revision to the % RTP is conservative, providing consistency with the other proposed changes from 25% RTP to 23% RTP that are associated with the fuel thermal limit monitoring threshold. (Refer to FUSAR Section 2.8.2.1.2.)

17. Fuel Storage, Criticality (TS 4.3.1)

    TS 4.3.1.1 includes spent fuel storage rack requirements for k-effective (current TS 4.3.1.1 a) and fuel assembly spacing (current TS 4.3.1.1 b). The proposed change adds a new TS 4.3.1.1 b to provide control of the maximum reactivity of fuel assemblies stored in the Spent Fuel Pool (SFP).

    TS 4.3.1.1 b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and

    The proposed limit is consistent with the BFN SFP Criticality Safety Analysis (CSA) documented in ANP-3160(P), Browns Ferry Nuclear Plant Units 1, 2, and 3 Spent Fuel Storage Pool Criticality Safety Analysis for ATRIUM 10XM Fuel, Revision 1. The proposed TS establishes an acceptance criterion that is based on the maximum fuel assembly reactivity result from the CSA. Therefore, the proposed change ensures that the safety margin established in the analysis is maintained. As a result of the addition of new TS 4.3.1.1 b, an administrative change is proposed to renumber the current TS requirement associated with fuel assembly spacing from TS 4.3.1.1 b to TS 4.3.1.1 c.

18. Primary Containment Leakage Rate Testing Program (TS 5.5.12)

    The peak calculated containment internal pressure for the design basis accident (DBA) loss of coolant accident (P_a) is being revised from 50.6 psig to 49.1 psig for BFN Units 2 and 3. For BFN Unit 1, the peak calculated containment internal pressure for the DBA loss of coolant accident (P_a) is being revised from 48.5 psig to 49.1 psig. The revised event initial conditions for EPU, the selection of mass and energy inputs for Units 2 and 3 to be consistent with the current licensing basis for Unit 1, and uniform modeling in the containment analysis for all three BFN units account for these changes. The same analytical inputs and

assumptions are now used in the containment analysis for all three BFN units. (Refer to PUSAR Sections 2.2.4.1 and 2.6.3.1 and Table 2.6-1.)

19. Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program (TS 5.5.14)

License Conditions 2.C.(13), 2.C.(14), and 2.C.(7), Transition License Condition 3, for Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3, respectively, incorporate by reference Table S-3 implementation item 49 of TVA letter CNL-15-224, dated October 20, 2015. Table S-3 implementation Item 49 states:

> Revise the program that monitors BFN Residual Heat Removal (RHR) heat exchanger performance for consistency with the assumptions of the NFPA [National Fire Protection Association] 805 Net Positive Suction Head (NPSH) analysis. The monitoring program shall include verification that the tested worst fouling resistance, with measurement uncertainty added, of all BFN Units 1, 2, and 3 RHR heat exchangers is less than the design value of 0.001517 hr-ft^2-°F/BTU and the worst tube plugging is less than 4.57 percent.

The NFPA 805 license condition associated with implementation item 49 is proposed to be deleted. The RHR Heat Exchanger Performance Monitoring Program has already been established as required by the NFPA 805 license condition. These NFPA 805 license condition requirements have been incorporated into the applicable implementing procedures.

In order to support deletion of the NFPA 805 license condition associated with implementation item 49, it is proposed to add RHR Heat Exchanger Performance Monitoring Program requirements to the Administrative Controls section of the BFN Technical Specifications (TS). Specifically, a new TS 5.5.14, "Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program," is proposed to be added. The TS requires the establishment of a program to ensure the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in the EPU containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The TS requires RHR heat exchanger performance testing and overall uncertainty in the fouling resistance to be performed in accordance with the guidelines in the EPRI report, EPRI 3002005340, "Service Water Heat Exchanger Guidelines," dated May 2015. The TS requires the program to include the following.

a. Provisions for periodically monitoring RHR heat exchanger performance, including frequency of monitoring and methodology for considering uncertainty of the result.
b. Acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.
c. Limitations and compensatory actions if degraded performance is observed.
d. Controls for changes to program requirements.

The TS requires the details of the program to be described in the Updated Final Safety Analysis Report (UFSAR).

Placing the RHR Heat Exchanger Performance Monitoring Program in the BFN TS, with details of the program included in the UFSAR, provides assurance BFN RHR heat exchanger performance will be maintained consistent with BFN analysis and licensing bases. Changes to the BFN analysis and licensing bases associated with the RHR Heat Exchanger Performance Monitoring Program details included in the UFSAR will be controlled in accordance with 10 CFR 50.59, "Changes, tests, and experiments."

Including the fouling resistance and tube plugging acceptance criteria in the UFSAR enables BFN to address the impact of potential heat exchanger degraded conditions, associated fouling resistance or tube plugging, on past operability/functionality within the TVA Corrective Action Program. The current NFPA 805 license condition, with explicit limits, does not facilitate this type of past thermal performance evaluation.

The proposed TS 5.5.14 wording is as follows.

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

3.2 Elimination of Containment Accident Pressure Credit

The current licensing basis for all three BFN units includes credit for CAP in determining available NPSH for ECCS pumps. As part of the proposed EPU, TVA is eliminating CAP credit assumptions in the BFN safety analyses. The elimination of CAP credit from the licensing basis is accomplished through system modifications and analytical assumption changes that are factored into the safety analyses.

The increase in core power due to EPU and the increased reactor steam flow rates were examined for the effect on heat loads to the suppression pool following postulated events. In order to maintain or improve suppression pool temperature margin, several changes are being made to the licensing basis. As discussed in Section 3.0, this change to the licensing basis includes changes that rely on more realistic analytical assumptions.

As part of the EPU, TVA is proposing a modification to increase the isotopic B-10 enrichment provided by the SLC System. Raising the boron-10 enrichment for EPU increases the rate of negative reactivity inserted by the SLC system and results in a faster shut down of the reactor during the ATWS event. This results in a reduced heat load input into the suppression pool; therefore, the suppression pool temperature is lower. SLC system shutdown requirements will continue to be evaluated on a cycle-specific basis using NRC-approved methods.

Containment heat removal and suppression pool temperature response was evaluated in accordance with the guidelines in NRC-approved licensing topical reports using NRC-approved methodologies. (Refer to PUSAR Section 2.6.5). The revised containment safety analysis, when combined with reduced heat exchanger fouling resistance (discussed in Attachment 39), decreases peak suppression pool temperatures further below current design limits.

The acceptability of ECCS pump NPSH based on the containment analysis suppression pool temperature response and without CAP credit is provided in PUSAR Section 2.6.5.2. NPSH evaluations are described in PUSAR Section 2.6.5.2 for the following events:

- Large Break LOCA Short-Term Phase
- Large Break LOCA Long-Term Phase
- Small Break LOCA
- Loss of Residual Heat Removal Shutdown Cooling
- Stuck Open Relief Valve with Reactor Pressure Vessel Isolation
- Fire Event
- Station Blackout
- ATWS

- Shutdown of the Non-Accident Unit Following Loss of Offsite Power and Accident in the Accident Unit

The ECCS pumps have been analyzed for plant-specific conditions and have sufficient NPSH margin to perform satisfactorily under postulated accident and transient conditions.

3.3 Plant Modifications Supporting Extended Power Uprate

The evaluations performed to support EPU identified that changes are required to certain safety and non-safety related systems, including minor equipment changes, replacements, and setpoint or alarm point changes. These changes will be made in accordance with the requirements of 10 CFR 50.59, "Changes, tests, and experiments," and do not require prior NRC approval through this EPU License Amendment Request. Some modifications have been implemented, as reflected in Attachment 47. The remaining modifications will be implemented prior to escalation above CLTP. Attachment 47 provides a status and listing of these modifications.

Any aspects of the modifications (i.e., associated TS or methodology changes) that require prior NRC approval are summarized in this Enclosure, in the TS changes, or methodology change sections.

Modifications that specifically address CAP credit elimination are listed in Section 3.2 of this Enclosure.

Additionally, the steam dryer in each unit is being replaced. Technical information regarding the replacement steam dryers is located in Attachment 40 (proprietary) and Attachment 41 (non-proprietary). The replacement of the steam dryers have been addressed for EPU and have no impact on other evaluations contained in the PUSAR. Additional discussion is provided below in Section 3.4.

3.4 Replacement Steam Dryers

TVA evaluated the existing BFN original equipment manufacturer steam dryers and determined that the steam dryers would not be suitable for EPU conditions without modifications. Therefore, TVA is replacing the existing BFN original equipment manufacturer steam dryers with replacement steam dryers manufactured by GEH. Refer to Attachments 40 (proprietary) and 41 (non-proprietary) for additional information regarding the replacement steam dryer design and analyses.

4.0 REGULATORY ANALYSIS

4.1 Applicable Regulatory Requirements/Criteria

TVA has determined that the proposed changes do not require any exemptions or relief from regulatory requirements and do not affect conformance with any General Design Criterion (GDC) differently than described in the UFSAR.

NEDC-33860P, "Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate," is provided as Attachment 6 (proprietary) and Attachment 7 (non-proprietary). Each PUSAR section contains a regulatory evaluation that describes the relevant regulatory requirements and criteria. A

technical evaluation is also included that explains the EPU changes and how the applicable regulatory requirements are met.

The PUSAR follows the format and guidance outlined in RS-001, "Review Standard for Extended Power Uprates," Revision 0 (Reference 6) to the extent that the review standard is consistent with the BFN design basis. For differences between plant-specific design bases and RS-001 regulatory evaluation sections, the corresponding PUSAR regulatory evaluation section was revised to reflect the BFN design basis.

The proposed EPU is based on the approaches described in the following documents:

- GE Nuclear Energy, "Constant Pressure Power Uprate," NEDC-33004P-A (CLTR), Revision 4, dated July 2003

- GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32424P-A (ELTR1), dated February 1999

- GE Nuclear Energy, "Generic Evaluation of General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32523P-A (ELTR2), dated February 1999

The PUSAR uses GEH GE14 fuel as the principal reference fuel type for the evaluation of the impact of EPU. However, the BFN units will utilize AREVA ATRIUM 10XM fuel, with some legacy ATRIUM 10 fuel, under EPU conditions. Therefore, the AREVA Fuel Uprate Safety Analysis Report (FUSAR) for Browns Ferry Units 1, 2, and 3 (Attachments 8 and 9) and fuel related reports are provided to supplement the PUSAR and address the effect of EPU conditions on the AREVA fuel in the BFN units.

The fuel-related reports are included in Attachments 10 through 38 and are as follows:

- ANP-3377, Browns Ferry Units 1, 2, and 3 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel (EPU)

- ANP-3378, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel (EPU)

- ANP-3384, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10 Fuel (EPU)

- ANP-3342, Browns Ferry EPU (120% OLTP) Equilibrium Fuel Cycle Design

- ANP-3372, Browns Ferry Unit 3 Cycle 19 EPU (120% OLTP) LAR Reference Fuel Cycle Design

- ANP-3404, Browns Ferry Unit 3 Cycle 19 Representative Reload Analysis at Extended Power Uprate

- ANP-3343, Nuclear Fuel Design Report Browns Ferry EPU (120% OLTP) Equilibrium Cycle ATRIUM 10XM Fuel
- ANP-3386, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10XM Fuel Assemblies
- ANP-3385, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10 Fuel Assemblies
- ANP-3388, Fuel Rod Thermal-Mechanical Evaluation for Browns Ferry Extended Power Uprate
- ANP-3327, Evaluation of AREVA Fuel Thermal-Hydraulic Performance for Browns Ferry at EPU
- FS1-0019629/30, Browns Ferry Unit 3 Cycle 19 MCPR Safety Limit Analysis With SAFLIM3D Methodology
- ANP-2860 Revision 2, Supplement 2, Browns Ferry Unit 1 – Summary of Responses to Request for Additional Information, Extension for Use of ATRIUM 10XM Fuel for Extended Power Uprate
- ANP-2637, Boiling Water Reactor Licensing Methodology Compendium
- ANP-3409, Fuel-Related Emergent Regulatory Issues

4.2 Precedent

The following approved extended power uprates were reviewed for precedent to the BFN request:

Precedent Relating to Extended Power Uprate (EPU)	
Precedent	Relevance and Deltas to EPU Proposed Licensing Action:
Peach Bottom Atomic Power Station 2 and 3 8/25/14 (ML14133A046) Amendment Nos. 293 and 296, respectively	Extended Power Uprate amendment increasing reactor core thermal power approximately 12.4%. Peach Bottom Atomic Power Station Units 2 and 3 are BWR 4s with Mark I containments similar to BFN Units 1, 2, and 3.
Grand Gulf 1, 07/18/12 (ML121210020) Amendment No. 191	Extended Power Uprate amendment increasing reactor core thermal power approximately 15%. Grand Gulf is a BWR 6 with a Mark III containment compared to BFN Units 1, 2, and 3, BWR 4s with Mark I containments.

Precedent Relating to Extended Power Uprate (EPU)	
Precedent	Relevance and Deltas to EPU Proposed Licensing Action:
St Lucie 1, 07/09/12 (ML12191A220) Amendment No. 213	Extended Power Uprate and Measurement Uncertainty Recapture (MUR) amendment increasing total reactor core thermal power approximately 11.9% (10.0% EPU and 1.7% MUR). St Lucie is a Pressurized Water Reactor (PWR) and of dissimilar design compared to BFN's BWR design.
Turkey Point 3 and 4, 06/15/12 (ML11293A359) Amendment Nos. 249 and 245, respectively	Extended Power Uprate and MUR amendment increasing total reactor core thermal power approximately 15% (13.0% EPU and 1.7% MUR). Turkey Point Units 3 and 4 are PWRs and of dissimilar design compared to BFN's BWR design.
Nine Mile Point 2, 12/22/11 (ML113300040) Amendment No. 140	Extended Power Uprate amendment increasing reactor core thermal power approximately 15%. Nine Mile Point 2 is a BWR 5 with a Mark II containment compared to BFN Units 1, 2, and 3 - BWR 4 with a Mark I containment.
Hope Creek, 05/14/08 (ML081230540) Amendment No. 174	Extended Power Uprate amendment increasing reactor core thermal power approximately 15%. Hope Creek is a BWR 4 with a Mark I containment similar to BFN Units 1, 2, and 3.
Susquehanna 1 and 2, 01/30/08 (ML081050530) Amendment Nos. 246 and 224, respectively	Extended Power Uprate amendment increasing reactor core thermal power approximately 13%. Susquehanna Units 1 and 2 are BWR 4s with Mark II containments. BFN Units 1, 2, and 3 are similar BWR 4 plants and vessel design with a difference in containment designs (Mark I versus Mark II).

Precedent Relating to Replacement Steam Dryers (RSD)	
Precedent	Relevance and Deltas to EPU Proposed Licensing Action:
Peach Bottom Atomic Power Station 2 and 3 8/25/14 (ML14133A046) Amendment 293 and 296, respectively	Extended Power Uprate increasing reactor core thermal power approximately 12.4%. The Peach Bottom Atomic Power Station Units 2 and 3 application included RSDs. The Peach Bottom Atomic Power Station Units 2 and 3 RSDs are of Westinghouse design.

Precedent Relating to Replacement Steam Dryers (RSD)	
Precedent	Relevance and Deltas to EPU Proposed Licensing Action:
Grand Gulf 1, 07/18/12 (ML121210020) Amendment 191	Extended Power Uprate increasing reactor core thermal power approximately 15%. The Grand Gulf application included an RSD. The Grand Gulf RSD is of GEH design.
Susquehanna 1 and 2, 01/30/08 (ML081050530) Amendment Nos. 246 and 224, respectively	Extended Power Uprate amendment increasing reactor core thermal power approximately 13%. The Susquehanna Units 1 and 2 application included RSDs. The Susquehanna RSDs are of GEH design.

Precedent Relating to Elimination of Containment Accident Pressure (CAP) Credit	
Precedent and Date	Relevance and Deltas to EPU Proposed Licensing Action:
Peach Bottom Atomic Power Station 2 and 3, 8/25/14 (ML14133A046) Amendment 293 and 296, respectively	Extended Power Uprate amendment increasing reactor core thermal power approximately 12.4% and eliminating credit for CAP to ensure adequate ECCS pump NPSH.

4.3 Significant Hazards Consideration

The Tennessee Valley Authority (TVA) is submitting an amendment request to Renewed Facility Operating Licenses DPR-33, DPR-52, and DPR-68 for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3, respectively, Technical Specifications (TS) and licensing bases. The proposed change revises the TS and licensing bases to support safe operation of BFN Units 1, 2, and 3 at an increased licensed reactor thermal power (RTP) of 3952 megawatts thermal (MWt); this is approximately 20% above the original licensed thermal power (OLTP) and approximately 14% above the current licensed thermal power (CLTP) of 3458 MWt. For BFN Units 2 and 3 only, because of proposed Extended Power Uprate (EPU) conditions, TVA is requesting a change in the maximum service water temperature and ultimate heat sink water temperature. As part of modifications supporting EPU, TVA is proposing elimination of the credit for containment accident pressure in certain analyses. In addition, as part of the amendment request, TVA is proposing the following changes.

- Adding a TS limitation for the maximum reactivity of fuel assemblies stored in the Spent Fuel Pool (SFP).

- Deleting the existing License Condition associated with Residual Heat Removal (RHR) Heat Exchanger performance monitoring and adding TS requirements for an RHR Heat Exchanger Performance Monitoring Program.

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 change increases the maximum authorized core power level for BFN from the current licensed thermal power (CLTP) of 3458 MWt to 3952 MWt. Evaluations and analysis of the nuclear steam supply system (NSSS) and balance of plant (BOP) structures, systems, and components (SSCs) that could be affected by the power uprate were performed in accordance with the approaches described in the following.

- GE Nuclear Energy, "Constant Pressure Power Uprate," NEDC-33004P-A (CLTR), Revision 4, dated July 2003
- GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32424P-A (ELTR1), dated February 1999
- GE Nuclear Energy, "Generic Evaluation of General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32523P-A (ELTR2), dated February 1999

The Power Uprate Safety Analysis Report (PUSAR) summarizes the results of safety evaluations performed that justify uprating the licensed thermal power at BFN. The PUSAR uses GEH GE14 fuel as the principal reference fuel type for the evaluation of the impact of EPU. However, the BFN units will utilize AREVA ATRIUM 10XM fuel, with some legacy ATRIUM 10 fuel, under EPU conditions. Therefore, the AREVA Fuel Uprate Safety Analysis Report (FUSAR) for Browns Ferry Units 1, 2, and 3 and fuel related reports are provided to supplement the PUSAR and address the impact of EPU conditions on the AREVA fuel in the BFN units. The AREVA analyses contained in the FUSAR have provided disposition of the critical characteristics of the GE14 fuel and have been shown to bound ATRIUM 10XM and ATRIUM 10 fuel.

The fuel-related reports are as follows:

- ANP-3377, Browns Ferry Units 1, 2, and 3 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel (EPU)
- ANP-3378, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel (EPU)

- ANP-3384, Browns Ferry Units 1, 2, and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10 Fuel (EPU)
- ANP-3342, Browns Ferry EPU (120% OLTP) Equilibrium Fuel Cycle Design
- ANP-3372, Browns Ferry Unit 3 Cycle 19 EPU (120% OLTP) LAR Reference Fuel Cycle Design
- ANP-3404, Browns Ferry Unit 3 Cycle 19 Representative Reload Analysis at Extended Power Uprate
- ANP-3343, Nuclear Fuel Design Report Browns Ferry EPU (120% OLTP) Equilibrium Cycle ATRIUM 10XM Fuel
- ANP-3386, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10XM Fuel Assemblies
- ANP-3385, Mechanical Design Report for Browns Ferry Units 1, 2 and 3 Extended Power Uprate (EPU) ATRIUM 10 Fuel Assemblies
- ANP-3388, Fuel Rod Thermal-Mechanical Evaluation for Browns Ferry Extended Power Uprate
- ANP-3327, Evaluation of AREVA Fuel Thermal-Hydraulic Performance for Browns Ferry at EPU
- FS1-0019629/30, Browns Ferry Unit 3 Cycle 19 MCPR Safety Limit Analysis With SAFLIM3D Methodology
- ANP-2860 Revision 2, Supplement 2, Browns Ferry Unit 1 – Summary of Responses to Request for Additional Information, Extension for Use of ATRIUM 10XM Fuel for Extended Power Uprate
- ANP-2637, Boiling Water Reactor Licensing Methodology Compendium
- ANP-3409, Fuel-Related Emergent Regulatory Issues

The evaluations concluded that all plant components, as modified, will continue to be capable of performing their design function at the proposed uprated core power level.

The BFN licensing and design bases, including BFN accident analysis, were also evaluated for the effect of the proposed power increase. The evaluation concluded that the applicable analysis acceptance criteria continue to be met.

Power level is not an initiator of any transient or accident; it is used as an input assumption to equipment design and accident analyses. The proposed change does not affect the release paths or the frequency of release for any accident previously evaluated in the FSAR. SSCs required to mitigate transients remain capable of performing their design functions considering radiological

consequences associated with the effect of the proposed EPU. The source terms used to evaluate the radiological consequences were reviewed and were determined to bound operation at EPU power levels. The results of EPU accident evaluations do not exceed NRC-approved acceptance limits.

The spectrum of postulated accidents and transients were reviewed and were shown to meet the regulatory criteria to which BFN is currently licensed. In the area of fuel and core design, the Safety Limit Minimum Critical Power Ratio (SLMCPR) and other Specified Acceptable Fuel Design Limits (SAFDLs) are still met. Continued compliance with the SLMPCR and other SAFDLs is confirmed on a cycle specific basis consistent with the criteria accepted by the NRC.

Challenges to the reactor coolant pressure boundary were evaluated at the EPU conditions of pressure, temperature, flow, and radiation and found to meet the acceptance criteria for allowable stresses. Adequate overpressure margin is maintained.

Challenges to the containment were also evaluated. The containment and its associated cooling system continue to meet applicable regulatory requirements. The calculated post event suppression pool temperatures remain within design limits, while ensuring adequate net positive suction head is maintained for required emergency core cooling system pumps.

Radiological releases were evaluated and found to be within the regulatory limits of 10 CFR 50.67, Accident Source Terms.

The modifications and methodology associated with the elimination of containment accident pressure credit do not change the design functions of the systems. By maintaining these functions, they do not significantly increase the probability or consequences of an accident previously evaluated.

The non-safety-related Replacement Steam Dryer (RSD) must function to maintain structural integrity and avoid generation of loose parts that may affect other SSCs. The RSD analyses demonstrate the structural integrity of the steam dryer is maintained at EPU conditions. Therefore, the RSD does not significantly increase the probability or consequences of an accident previously evaluated.

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 change increases the maximum authorized core power level for BFN from the current licensed thermal power (CLTP) of 3458 MWt to 3952 MWt. An evaluation of the equipment that could be affected by the power uprate has been performed. No new accident scenarios or equipment failure modes were identified. The full spectrum of accident considerations was evaluated and no new or different kinds of accidents were identified. For BFN, the standard evaluation methods outlined in the CLTR, ELTR1, ELTR2, PUSAR, FUSAR, and

fuel related reports were applied to the capability of existing or modified safety-related plant equipment. No new accidents or event precursors were identified.

All SSCs previously required for mitigation of a transient remain capable of fulfilling their intended design functions. The proposed increase in power does not adversely affect safety-related systems or components and does not challenge the performance or integrity of any safety-related systems. The change does not adversely affect any current system interfaces or create any new interfaces that could result in an accident or malfunction of a different kind than was previously evaluated. Operating at the proposed EPU power level does not create any new accident initiators or precursors.

The modifications and methodology associated with the elimination of containment accident pressure credit do not change the design functions of the systems. The systems are not accident initiators and by maintaining their current function they do not create the possibility of a new or different kind of accident.

The new RSD does not have any new design functions. RSD analyses demonstrate that the RSD will be capable of performing the design function of maintaining structural integrity. Therefore, there are no new or different kinds of accidents from those previously evaluated.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

Response: No.

Based on the analyses of the proposed power increase, the relevant design and safety acceptance criteria will be met without significant adverse effects or reduction in margins of safety. The analyses supporting EPU have demonstrated that the BFN SSCs are capable of safely performing at EPU conditions. The analyses identified and defined the major input parameters to the NSSS, and NSSS design transients, and evaluated the capability of the primary containment, NSSS fluid systems, NSSS and BOP components, as appropriate. Radiological consequences of design basis events remain within regulatory limits and are not increased significantly. The analyses confirmed that NSSS and BOP SSCs are capable of achieving EPU conditions without significant reduction in margins of safety, with the modifications discussed in this application.

Analyses have shown that the integrity of primary fission product barriers will not be significantly affected as a result of the power increase. Calculated loads on SSCs important to safety have been shown to remain within design allowables under EPU conditions for all design basis event categories. Plant response to transients and accidents do not result in exceeding acceptance criteria.

As appropriate, the evaluations that demonstrate acceptability of EPU have been performed using methods that have either been reviewed and approved by the NRC staff, or that are in compliance with regulatory review guidance and standards established for maintaining adequate margins of safety. These

evaluations demonstrate that there are no significant reductions in the margins of safety.

Maximum power level is one of the inherent inputs that determine the safe operating range defined by the accident analyses. The Technical Specifications ensure that BFN is operated within the bounds of the inputs and assumptions used in the accident analyses. The acceptance criteria for the accident analyses are conservative with respect to the operating conditions defined by the Technical Specifications. The engineering reviews performed for the constant pressure EPU confirm that the accident analyses criteria are met at the revised maximum allowed thermal power of 3952 MWt. Therefore, the adequacy of the renewed Facility Operating License and Technical Specifications to maintain the plant in a safe operating range is also confirmed, and the increase in maximum allowable power level does not involve a significant decrease in a margin of safety.

The modifications and methodology associated with the elimination of containment accident pressure credit do not change the design functions within the applicable limits. The credit is associated with accident or event response and does not significantly affect accident initiators by maintaining their current functions and does not create the possibility of a new or different kind of accident. The proposed Technical Specifications associated with these modifications ensure that BFN is operated within the bounds of the inputs and assumptions used in the accident analyses.

The steam dryer is being replaced in order to ensure adequate margin to the established structural requirements is maintained. The new RSD does not have any new design functions and an analysis was performed to confirm it will be capable of maintaining its structural integrity. The power ascension test plan will verify that the RSD conservatively meets the vibration and stress requirements.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendments do not involve a significant hazard consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusion

In conclusion, based on the considerations discussed above, (1) there is a 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.

5.0 ENVIRONMENTAL CONSIDERATIONS

The environmental considerations evaluation is contained in Attachment 42, Supplemental Environmental Report. It concludes that EPU will not result in a significant change in non-radiological impacts on land use, water use, waste discharges, terrestrial and aquatic biota, transmission facilities, or social and economic factors, and will have no non-radiological environmental impacts other than

those evaluated in the Supplemental Environmental Report. The Supplemental Environmental Report further concludes that EPU will not introduce any new radiological release pathways, will not result in a significant increase in occupational or public radiation exposures, and will not result in significant additional fuel cycle environmental impacts.

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 effluents 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.

6.0 REFERENCES

1. NRC Letter to TVA, "Browns Ferry Nuclear Plant, Unit 1 - Issuance of Amendment Regarding Five Percent Power Uprate (TAC No. MD3048) (TS-431)," dated March 6, 2007; (ADAMS Accession No. ML063350404).

2. NRC Letter to TVA, "Issuance of Amendments RE: Power Uprate - Browns Ferry Plant, Units 2 and 3 - (TAC Nos. M99711 and M99712)," dated September 8, 1998; (ADAMS Accession No. ML020100022)

3. GE Nuclear Energy, "Constant Pressure Power Uprate," NEDC-33004P-A (CLTR), Revision 4, dated July 2003.

4. GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32424P-A (ELTR1), dated February 1999.

5. GE Nuclear Energy, "Generic Evaluation of General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32523P-A (ELTR2), dated February 1999.

6. NRC, Office of Nuclear Reactor Regulation, Review Standard RS-001, "Review Standard for Extended Power Uprates," Revision 0, dated December 2003.

7. NRC Regulatory Guide (RG) 1.82, "Water Source for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," Revision 4, March 2012; (ADAMS Accession No. ML111330278).

8. NRC Letter to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Issuance of Amendments Regarding Full-Scope Implementation of Alternative Source Term (TAC Nos. MB5733, MB5734, MB5735, MC0156, MC0157 and MC0158) (TS-405)," dated September 27, 2004; (ADAMS Accession No. ML042730028).

9. NRC Letter to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Issuance of Amendments Regarding The Instrument Setpoint Program (TAC Nos. MC9518, MC9519, and MC9520) (TS-453)," dated September 14, 2006; (ADAMS Accession No. ML061680008).

10. TVA Letter to NRC, "Browns Ferry Nuclear Plant (BFN), Unit 1 - Application to Modify Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits (BFN TS-484)," dated December 18, 2013; (ADAMS Accession No. ML13358A067).

11. TVA Letter to NRC, "Browns Ferry Nuclear Plant (BFN), Unit 2 - Application to Modify Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits (BFN TS-491)," dated June 19, 2014; (ADAMS Accession No. ML14175A307).

12. TVA Letter to NRC, "Browns Ferry Nuclear Plant (BFN), 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).

13. NRC Letter to TVA, “Browns Ferry Nuclear Plant, Unit 1 – Issuance of Amendment Revising Pressure and Temperature Limit Curves (TAC No. MF3260),” dated February 2, 2015; (ADAMS Accession No. ML14325A501).

14. Not used.

15. NRC Letter to TVA, “Browns Ferry Nuclear Plant, Units 2 and 3 – Issuance of Amendments Regarding Limits on Main Steam Isolation Valve Leakage (TAC Nos. MA6405 and MA6406),” dated March 14, 2000; (ADAMS Accession No. ML003693000).

16. NRC Letter to TVA, “Browns Ferry Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Limits on Main Steam Isolation Valve Leakage (TAC No. MC3813),” dated September 27, 2006; (ADAMS Accession No. ML062210458).

17. NRC Letter to TVA, “Browns Ferry Nuclear Plant, Unit 2 – Issuance of Amendment Revising Pressure and Temperature Limit Curves (TAC No. MF4303),” dated June 2, 2015; (ADAMS Accession No. ML15065A049).

18. NRC Letter to TVA, “Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Issuance of Amendments Regarding Technical Specification (TS) Change TS-478 Addition of Analytical Methodologies to TS 5.6.5 and Revision of TS 2.1.1.2 for Unit 2 (TAC Nos. MF0877, MF0878, and MF0879),” dated July 31, 2014; (ADAMS Accession No. ML14113A286).

19. TVA Letter to NRC, “Browns Ferry Nuclear Plant (BFN), Unit 3 – Application to Modify Technical Specification 2.1.1.2, Reactor Core Minimum Critical Power Ratio Safety Limits (TS-499),” dated March 6, 2015; (ADAMS Accession No. ML15090A436).

20. Not used.

21. NRC letter to TVA, “Browns Ferry Nuclear Plant, Unit 3 - Issuance of Amendment Regarding Modification of Technical Specification 3.4.9, “RCS Pressure and Temperature (P/T) Limits” (CAC No. MF5659), dated January 7, 2016; (ADAMS Accession No. ML15344A321).

ENCLOSURE 2

Supplement to BFN EPU LAR, Attachment 2,
Proposed Technical Specification Changes (Markups)

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC Safety Evaluation dated October 28, 2015, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the following modifications to its facility, as described in Table S-2, "Plant Modifications," of Tennessee Valley Authority letter CNL-15-191, dated September 8, 2015, to complete the transition to full compliance with 10 CFR 50.48(c) no later than the end of the second refueling outage (for each unit) following issuance of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-15-224, dated ~~October 20, 2015~~ 16-165 October 31, 2016, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(14) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analyses Report (UFSAR).

(15) The licensee is required to confirm that the conclusions made in TVA's letter dated September 17, 2004, for the turbine building remain acceptable using seismic demand accelerations based on dynamic seismic analysis prior to the restart of Unit 1.

(16) Upon implementation of Amendment No. 275, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.3.4, in accordance with TS 5.5.13.c(i), the assessment of the CRE habitability as required by TS 5.5.13.c(ii), and the measure of CRE pressure as required by TS 5.5.13.d, shall be considered met.

Following Implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c.(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c.(ii), shall be within 9 months following the initial implementation of the TS Change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c.(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be within 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

(17) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, "AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0," (i.e., TS 5.6.5.b.11) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which the model uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 285.

Insert BFN Unit 1 - 2.C(18)

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than December 20, 2013, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

F. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of the most recent NRC-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) appropriate for the configuration of the specimens in the capsule. Any changes to the BWRVIP ISP capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage

Insert BFN Unit 1 - 2.C(18)

(18) Potential Adverse Flow Effects

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 1 steam dryer testing. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up.

2. TVA shall monitor the main steam line (MSL) strain gauges at a minimum of three power levels up to 3458 MWt. If the number of active MSL strain gauges is less than two strain gauges (180 degrees apart) at any of the eight MSL locations, TVA will stop power ascension and repair/replace the damaged strain gauges and only then resume power ascension.

3. At least 90 days prior to the start of the BFN Unit 1 EPU outage, TVA shall revise the BFN Unit 1 replacement steam dryer (RSD) analysis utilizing the BFN Unit 3 on-dryer strain gauge based end-to-end Bias errors and Uncertainties (B/Us) at EPU conditions, and submit the information including the updated limit curves and a list of dominant frequencies for BFN Unit 1, to the NRC as a report in accordance with 10 CFR 50.4.

   a. If the on-dryer instrumentation was not available when BFN Unit 3 reached a power level of 3458 MWt and the BFN-specific bias and uncertainty data and transfer function could not be developed, the predicted dryer loads during the BFN Unit 1 power ascension will be calculated with the Plant Based Load Evaluation Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will be based on BFN Unit 3 steam dryer confirmatory stress analysis results using the MSL strain gauge data collected at EPU conditions. The acceptance limits will ensure the steam dryer stress margins remain above the minimum alternating stress ratio (MASR) determined in the BFN Unit 3 steam dryer EPU confirmatory analyses.

4. TVA shall evaluate the BFN Unit 1 limit curves prepared in item (a)3 above based on new MSL strain gauge data collected following the BFN Unit 1 EPU outage at or near 3458 MWt. If the limit curves change, the new post-EPU outage limit curves shall be provided to the NRC Project Manager. TVA shall not

increase power above 3458 MWt for at least 96 hours after the NRC Project Manager confirms receipt of the reports unless, prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

5. TVA shall monitor the MSL strain gauges during power ascension above 3458 MWt for increasing pressure fluctuations in the steam lines. Upon the initial increase of power above 3458 MWt until reaching 3952 MWt, TVA shall collect data from the MSL strain gauges at nominal 2.5% of 3458 MWt (approximately 86 MWt) increments and evaluate steam dryer performance based on this data.

6. During power ascension at each nominal 2.5 percent power level above 3458 MWt (approximately 86 MWt), TVA shall compare the MSL data to the approved limit curves based on end-to-end B/Us from the BFN Unit 3 benchmarking at EPU conditions and determine the MASR.

7. TVA shall hold the facility at approximately 3630 MWt and 3803 MWt to perform the following:

   a. Collect strain data from the MSL strain gauges.

   b. Collect vibration data for the locations included in the vibration summary report discussed above.

   c. Evaluate steam dryer performance based on MSL strain gauge data.

   d. Evaluate the measured vibration data (collected in item 7.b above) at that power level, data projected to EPU conditions, trends, and comparison with the acceptance limits.

   e. Provide the steam dryer evaluation and the vibration evaluation, including the data collected, to the NRC Project Manager, upon completion of the evaluation for each of the hold points.

   f. TVA shall not increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the evaluations unless, prior to the expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

8. If any frequency peak from the MSL strain gauge data exceeds the Level 1 limit curves, TVA shall return the facility to a power level at which the limit curve is not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. If a revised stress analysis is performed and new limit

curves are developed, then TVA shall not further increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the documentation or until the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension, whichever comes first. Additional detail is provided in item (b)1 below.

(b) TVA shall implement the following actions for the initial power ascension from 3458 MWt to 3952 MWt condition:

1. In the event that acoustic signals (in MSL strain gauge signals) are identified that exceed the Level 1 limit curves during power ascension above 3458 MWt, TVA shall re-evaluate dryer loads and stresses, and re-establish the limit curves. In the event that stress analyses are re-performed based on new strain gauge data to address item (a)7 above, the revised load definition, stress analysis, and limit curves shall include:

   a. Application of end-to-end B/Us as determined from BFN Unit 3 EPU measurements.

   b. Use of scaling factors associated with all of the SRV acoustic resonances as estimated in the predictive analysis or in-plant data acquired during power ascension.

2. After reaching 3952 MWt, TVA shall obtain measurements from the MSL strain gauges and establish the steam dryer flow-induced vibration load fatigue margin for the facility and update the steam dryer stress report. These data will be provided to the NRC staff as described below in item (e).

(c) TVA shall prepare the EPU PAT Plan to include the following.

1. The MSL strain gauge limit curves to be applied for evaluating steam dryer performance, based on end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions.

2. Specific hold points and their durations during EPU power ascension.

3. Activities to be accomplished during the hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters, and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the application and all supplements to the application in support of the EPU license amendment request pertaining to the steam dryer prior to power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval:

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made in accordance with the guidance of NEI 99-04, "Guidelines for Managing NRC Commitments," issued July 1999.

(e) Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions. The report shall be submitted to NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 1. Should the results of this stress analysis indicate the allowable stress in any part of the steam dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the steam dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of steam dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

(f) Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 1. The vibration summary report shall include the information in items (f)1 through (f)3, as follows:

1. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015, including the identified locations associated with MSLs , Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

2. An evaluation of the measured vibration data collected in

item (f)1 above compared against acceptance limits.

3. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item (f)1, above.

(g) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(h) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted to the NRC within 90 days following startup from each of the first two respective refueling outages.

(i) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in items (g) and (h), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in item (i).

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

~~b.~~ A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and
c.

(continued)

5.5 Programs and Manuals

5.5.13 Control Room Envelope Habitability Program (continued)

a. The definition of CRE and the CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors, " Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0.

d. Measurements, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by one subsystem of the CREV System, operating at the flow rate required by the VFTP, at a frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

e. The quantitative limits on unfiltered air leakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage for flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of the CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

Insert 5.5.14

Insert 5.5.14

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9);
- Gaseous Fire Suppression Systems (Section 3.10); and
- Passive Fire Protection Features (Section 3.11).

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC Safety Evaluation dated October 28, 2015, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the following modifications to its facility, as described in Table S-2, "Plant Modifications," of Tennessee Valley Authority letter CNL-15-191, dated September 8, 2015, to complete the transition to full compliance with 10 CFR 50.48(c) no later than the end of the second refueling outage (for each unit) following issuance of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

16-165

October 31, 2016

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-~~15-224~~, dated ~~October 20, 2015~~, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(15) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analysis Report (UFSAR).

(16) Upon complementation of Amendment No. 302, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3. 7.3.4, in accordance with TS 5.5.13.c(i), the assessment of the CRE habitability as required by TS 5.5.13.c(ii), and the measure of CRE pressure as required by TS 5.5.13.d, shall be considered met.

Following implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c.(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c.(ii), shall be within 9 months following the initial implementation of the TS change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c.(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be with 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

Insert BFN Unit 2 - 2.C(18)

(17) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, "AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0," (i.e., TS 5.6.5.b.10) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which the model uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 311.

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than June 28, 2014, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

F. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of the most recent NRC-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) appropriate for the configuration of the specimens in the

Insert BFN Unit 2 - 2.C(18)

(18) Potential Adverse Flow Effects

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 2 steam dryer testing. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up.

2. TVA shall monitor the main steam line (MSL) strain gauges at a minimum of three power levels up to 3458 MWt. If the number of active MSL strain gauges is less than two strain gauges (180 degrees apart) at any of the eight MSL locations, TVA will stop power ascension and repair/replace the damaged strain gauges and only then resume power ascension.

3. At least 90 days prior to the start of the BFN Unit 2 EPU outage, TVA shall revise the BFN Unit 2 replacement steam dryer (RSD) analysis utilizing the BFN Unit 3 on-dryer strain gauge based end-to-end Bias errors and Uncertainties (B/Us) at EPU conditions, and submit the information including the updated limit curves and a list of dominant frequencies for BFN Unit 2, to the NRC as a report in accordance with 10 CFR 50.4.

   a. If the on-dryer instrumentation was not available when BFN Unit 3 reached a power level of 3458 MWt and the BFN-specific bias and uncertainty data and transfer function could not be developed, the predicted dryer loads during the BFN Unit 2 power ascension will be calculated with the Plant Based Load Evaluation Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will be based on BFN Unit 3 steam dryer confirmatory stress analysis results using the MSL strain gauge data collected at EPU conditions. The acceptance limits will ensure the steam dryer stress margins remain above the minimum alternating stress ratio (MASR) determined in the BFN Unit 3 steam dryer EPU confirmatory analyses.

4. TVA shall evaluate the BFN Unit 2 limit curves prepared in item (a)3 above based on new MSL strain gauge data collected following the BFN Unit 2 EPU outage at or near 3458 MWt. If the limit curves change, the new post-EPU outage limit curves shall be provided to the NRC Project Manager. TVA shall not increase power above 3458 MWt for at least 96 hours after the NRC Project Manager confirms receipt of the reports unless, prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

5. TVA shall monitor the MSL strain gauges during power ascension above 3458 MWt for increasing pressure fluctuations in the steam lines. Upon the initial increase of power above 3458 MWt until reaching 3952 MWt, TVA shall collect data from the MSL strain gauges at nominal 2.5% of 3458 MWt (approximately 86 MWt) increments and evaluate steam dryer performance based on this data.

6. During power ascension at each nominal 2.5 percent power level above 3458 MWt (approximately 86 MWt), TVA shall compare the MSL data to the approved limit curves based on end-to-end B/Us from the BFN Unit 3 benchmarking at EPU conditions and determine the MASR.

7. TVA shall hold the facility at approximately 3630 MWt and 3803 MWt to perform the following:

    a. Collect strain data from the MSL strain gauges.

    b. Collect vibration data for the locations included in the vibration summary report discussed above.

    c. Evaluate steam dryer performance based on MSL strain gauge data.

    d. Evaluate the measured vibration data (collected in item 7.b above) at that power level, data projected to EPU conditions, trends, and comparison with the acceptance limits.

    e. Provide the steam dryer evaluation and the vibration evaluation, including the data collected, to the NRC Project Manager, upon completion of the evaluation for each of the hold points.

    f. TVA shall not increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the evaluations unless, prior to the expiration of the 96 hour period, the NRC Project Manager advises that the NRC

staff has no objections to the continuation of power ascension.

8. If any frequency peak from the MSL strain gauge data exceeds the Level 1 limit curves, TVA shall return the facility to a power level at which the limit curve is not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. If a revised stress analysis is performed and new limit curves are developed, then TVA shall not further increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the documentation or until the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension, whichever comes first. Additional detail is provided in item (b)1 below.

(b) TVA shall implement the following actions for the initial power ascension from 3458 MWt to 3952 MWt condition:

1. In the event that acoustic signals (in MSL strain gauge signals) are identified that exceed the Level 1 limit curves during power ascension above 3458 MWt, TVA shall re-evaluate dryer loads and stresses, and re-establish the limit curves. In the event that stress analyses are re-performed based on new strain gauge data to address item (a)7 above, the revised load definition, stress analysis, and limit curves shall include:

   a. Application of end-to-end B/Us as determined from BFN Unit 3 EPU measurements.

   b. Use of scaling factors associated with all of the SRV acoustic resonances as estimated in the predictive analysis or in-plant data acquired during power ascension.

2. After reaching 3952 MWt, TVA shall obtain measurements from the MSL strain gauges and establish the steam dryer flow-induced vibration load fatigue margin for the facility and update the steam dryer stress report. These data will be provided to the NRC staff as described below in item (e).

(c) TVA shall prepare the EPU PAT Plan to include the following.

1. The MSL strain gauge limit curves to be applied for evaluating steam dryer performance, based on end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions.

2. Specific hold points and their durations during EPU power ascension.

3. Activities to be accomplished during the hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters, and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the application and all supplements to the application in support of the EPU license amendment request pertaining to the steam dryer prior to power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval:

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made accordance with the guidance of NEI 99-04, “Guidelines for Managing NRC Commitments,” issued July 1999.

(e) Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions. The report shall be submitted to NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 2. Should the results of this stress analysis indicate the allowable stress in any part of the steam dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the steam dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of steam dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

(f) Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 2. The vibration summary report shall include the information in items (f)1 through (f)3, as follows:

1. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015, including the identified locations associated with MSLs, Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

2. An evaluation of the measured vibration data collected in item (f)1 above compared against acceptance limits.

3. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item f(1), above.

(g) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(h) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted within 90 days following startup from each of the first two respective refueling outages.

(i) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in items (g) and (h), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in item (i).

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

~~b.~~ A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and
c.

(continued)

5.5 Programs and Manuals

5.5.13 Control Room Envelope Habitability Program (continued)

a. The definition of CRE and the CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0.

d. Measurements, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by one subsystem of the CREV System, operating at the flow rate required by the VFTP, at a frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

e. The quantitative limits on unfiltered air leakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage for flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of the CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

Insert 5.5.14

Insert 5.5.14

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-~~15-224~~, dated ~~October 20, 2015~~, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(8) Deleted.

(9) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analyses Report (UFSAR).

(10) Mitigation Strategy License Condition

Develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

(a) Fire fighting response strategy with the following elements:
   1. Pre-defined coordinated fire response strategy and guidance
   2. Assessment of mutual aid fire fighting assets
   3. Designated staging areas for equipment and materials
   4. Command and control
   5. Training of response personnel

(b) Operations to mitigate fuel damage considering the following:
   1. Protection and use of personnel assets
   2. Communications
   3. Minimizing fire spread
   4. Procedures for implementing integrated fire response strategy
   5. Identification of readily-available pre-staged equipment
   6. Training on integrated fire response strategy
   7. Spent fuel pool mitigation measures

(c) Actions to minimize release to include consideration of:
   1. Water spray scrubbing
   2. Dose to onsite responders

(11) The licensee shall implement and maintain all Actions required by Attachment 2 to NRC Order EA-06-137, issued June 20, 2006, except the last action that requires incorporation of the strategies into the site security plan, contingency plan, emergency plan and/or guard training and qualification plan, as appropriate.

(12) Upon completion of Amendment No. 261, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.3.4, in accordance with TS 5.S.13.c(i), the assessment of the CRE habitability as required by TS 5.S.13.c(ii), and the measurement of the CRE pressure as required by TS 5.S.13.d. shall be considered met.

(3) Following Implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c.(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c.(ii), shall be within 9 months following the initial implementation of the TS Change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c.(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be within 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

(d) For License Amendment 268 ,the licensee shall implement changes to BFN, Unit 3 TSs 5.6.5 and 3.3.1.1 within 60 days of approval. The remaining BFN, Unit 3, changes will be implemented upon completion of required supporting modification work and prior to entering Mode 3 (i.e., Hot Shutdown) from the spring 2014 refueling outage.

(13) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, "AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0," (i.e., TS 5.6.5.b.10) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which the model uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 270.

Insert BFN Unit 3 - 2.C(14)

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than July 2, 2016, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

Insert BFN Unit 3 - 2.C(14)

(14) Potential Adverse Flow Effects

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 3 steam dryer testing. This plan shall include:

   a. Criteria for comparison and evaluation of projected strain and acceleration with on-dryer instrument data.

   b. Acceptance limits developed for each on-dryer strain gauge.

   c. Tables of predicted dryer stresses at a power level of 3458 MWt, strain amplitudes and PSDs at strain gauge locations, and maximum stresses and locations.

   The PAT plan shall provide correlations between measured strains and the corresponding maximum stresses. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up.

2. TVA shall monitor the main steam line (MSL) strain gauges and on-dryer instrumentation at a minimum of three power levels up to 3458 MWt. Based on a comparison of projected and measured strains and accelerations, BFN will assess whether the dryer acoustic and structural models have adequately captured the response significant to peak stress projections. If the measured strains and accelerations are not within the 3458 MWt acceptance limits, the new measured data will be used to re-perform the full structural re-analysis for the purposes of generating modified EPU acceptance limits.

   a. If the on-dryer instrumentation is unavailable, the BFN Unit 3 power ascension will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the Plant Based Load Evaluation (PBLE) Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will ensure that the steam dryer stress margins remain above the final minimum

alternating stress ratio (MASR) accepted in the EPU design analyses.

3. BFN shall provide a summary of the data and evaluation of predicted and measured pressures, strains, and accelerations at a power level of 3458 MWt. This data will include the BFN-specific bias and uncertainty data and transfer function, revised peak stress table and any revised acceptance limits. The predicted pressures shall include those using both PBLE methods (that is, Method 1 using on-dryer data, and Method 2 using MSL data). It shall be provided to the NRC Project Manager upon completion of the evaluation. TVA shall not increase power above 3458 MWt until the NRC PM notifies TVA that NRC accepts the evaluation or NRC questions regarding the evaluation have been addressed. If no questions are identified within 240 hours after the NRC receives the evaluation, power ascension may continue.

   a. If the on-dryer instrumentation is unavailable and the BFN-specific bias and uncertainty data and transfer function cannot be developed when BFN Unit 3 reaches a power level of 3458 MWt, the BFN Unit 3 power ascension above 3458 MWt will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the PBLE Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will ensure that the steam dryer stress margins remain above the final MASR accepted in the EPU design analyses.

(b) The following requirements are placed on operation of the facility during the initial power ascension from 3458 MWt to the approved EPU level (3952 MWt):

1. At test increments that do not exceed 2.5% of 3458 MWt (approximately 86 MWt), TVA shall hold the facility at approximately steady state conditions and collect data from available MSL strain gauges and available on-dryer instrumentation. This data will be evaluated, including the comparison of measured dryer strains to acceptance limits and the comparison of predicted dryer loads based on MSL strain gauge data to acceptance limits. It will also be used to trend and project loads at the next test point and to EPU conditions to demonstrate margin for continued power ascension.

   a. If the on-dryer instrumentation becomes unavailable during power ascension above 3458 MWt, the BFN Unit 3 power ascension above 3458 MWt will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the BFN-specific PBLE Method 2 transfer function developed from the on-dryer instrumentation and MSL strain gauge data taken at the 3458 MWt hold point, the BFN-specific

bias and uncertainty data, the revised peak stresses, and revised acceptance criteria developed in item (a)3 above. The acceptance limits will maintain the steam dryer stress margins above a MASR of 1.0.

2. Following the data collection and evaluation at the plateaus at approximately 3630 MWt, 3803 MWt, and 3952 MWt, TVA shall provide a summary of the data and the evaluation performed in item (b)1 above to the NRC Project Manager. TVA shall not increase power above these power levels for up to 96 hours after the NRC Project Manager confirms receipt of the summary, unless prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objection to continuation of power ascension.

3. Should the measured strains on the dryer exceed the Level 1 acceptance limits, or alternatively if the dryer instrumentation is not available and the projected load on the dryer from the MSL strain gauge data exceeds the Level 1 acceptance limits, TVA shall return the facility to a power level at which the limits are not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. TVA shall not increase power for up to 96 hours to allow for NRC review and approval of the information.

   a. In the event that acoustic signals (in MSL strain gauge signals) are identified that challenge the dryer acceptance limits during power ascension above 3458 MWt, TVA shall evaluate dryer loads, and stresses, including the effect of ±10 percent frequency shift, and re-establish the acceptance limits and determine whether there is margin for continued power ascension.

   b. During power ascension above 3458 MWt, if an engineering evaluation for the steam dryer is required because a Level 1 acceptance limit is exceeded, TVA shall perform the structural analysis using the Steam Dryer Report, Appendix A methods to address frequency uncertainties up to ±10% and assure that peak responses that fall within this uncertainty band are addressed.

4. a. Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the BFN-specific bias and uncertainties and transfer function, to the NRC. The BFN-specific bias and uncertainties summary shall include both PBLE Method 1 and Method 2. This report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 3. Should the results of this stress analysis indicate the allowable stress in any part of the dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

b. Within 30 days after completion of the core flow sweep test at EPU conditions to determine any compounding effect due to alignment of Vane Passing Frequency and Safety Relief Valve resonance frequencies, the TVA shall provide the core flow sweep test results for NRC review.

5. Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 3 The vibration summary report shall include the information in items 5.a through 5.c, as follows:

a. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015, including the identified locations associated with MSLs, Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

b. An evaluation of the measured vibration data collected in item 5.a above compared against acceptance limits.

c. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item 5.a, above.

(c) TVA shall prepare the EPU PAT plan to include the following.

1. Level 1 and Level 2 acceptance limits for on-dryer strain gauges and for projected dryer loads from MSL strain gauge data to be used up to 3952 MWt.

2. Specific hold points and their duration during EPU power ascension.

3. Activities to be accomplished during hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the TVA application and all supplements to the application in support of the EPU LAR pertaining to the steam dryer before power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval.

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made in accordance with the guidance of NEI 99-04, “Guidelines for Managing NRC Commitments,” issued July 1999.

(e) During the first two scheduled refueling outages after reaching full EPU conditions, TVA shall conduct a visual inspection of all accessible, susceptible locations of the steam dryer in accordance with BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(f) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted to NRC within 90 days following startup from each of the first two respective refueling outages.

(g) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

This license condition described above shall expire: (1) upon satisfaction of the requirements in items (e) and (f) provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is caused by fatigue, and; (2) upon satisfaction of the requirements specified in item (g).

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

~~b.~~ A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and
c.

(continued)

5.5 Programs and Manuals

5.5.13 Control Room Envelope Habitability Program (continued)

a. The definition of CRE and the CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0.

d. Measurements, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by one subsystem of the CREV System, operating at the flow rate required by the VFTP, at a frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

e. The quantitative limits on unfiltered air leakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage for flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of the CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

Insert 5.5.14

Insert 5.5.14

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

ENCLOSURE 3

Supplement to BFN EPU LAR, Attachment 3,
Retyped Proposed Technical Specification Changes

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC Safety Evaluation dated October 28, 2015, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the following modifications to its facility, as described in Table S-2, "Plant Modifications," of Tennessee Valley Authority letter CNL-15-191, dated September 8, 2015, to complete the transition to full compliance with 10 CFR 50.48(c) no later than the end of the second refueling outage (for each unit) following issuance of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-116-165, dated October 31, 2016, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(14) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analyses Report (UFSAR).

(15) The licensee is required to confirm that the conclusions made in TVA's letter dated September 17, 2004, for the turbine building remain acceptable using seismic demand accelerations based on dynamic seismic analysis prior to the restart of Unit 1.

(16) Upon implementation of Amendment No. 275, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.3.4, in accordance with TS 5.5.13.c(i), the assessment of the CRE habitability as required by TS 5.5.13.c(ii), and the measure of CRE pressure as required by TS 5.5.13.d, shall be considered met.

Following Implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c.(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c.(ii), shall be within 9 months following the initial implementation of the TS Change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c.(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be within 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

(17) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, "AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0," (i.e., TS 5.6.5.b.11) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which the model uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 285.

(18) **Potential Adverse Flow Effects**

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 1 steam dryer testing. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up

2. TVA shall monitor the main steam line (MSL) strain gauges at a minimum of three power levels up to 3458 MWt. If the number of active MSL strain gauges is less than two strain gauges (180 degrees apart) at any of the eight MSL locations, TVA will stop power ascension and repair/replace the damaged strain gauges and only then resume power ascension.

3. At least 90 days prior to the start of the BFN Unit 1 EPU outage, TVA shall revise the BFN Unit 1 replacement steam dryer (RSD) analysis utilizing the BFN Unit 3 on-dryer strain gauge based end-to-end Bias errors and Uncertainties (B/Us) at

EPU conditions, and submit the information including the updated limit curves and a list of dominant frequencies for BFN Unit 1, to the NRC as a report in accordance with 10 CFR 50.4.

a. If the on-dryer instrumentation was not available when BFN Unit 3 reached a power level of 3458 MWt and the BFN-specific bias and uncertainty data and transfer function could not be developed, the predicted dryer loads during the BFN Unit 1 power ascension will be calculated with the Plant Based Load Evaluation Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will be based on BFN Unit 3 steam dryer confirmatory stress analysis results using the MSL strain gauge data collected at EPU conditions. The acceptance limits will ensure the steam dryer stress margins remain above the minimum alternating stress ratio (MASR) determined in the BFN Unit 3 steam dryer EPU confirmatory analyses.

4. TVA shall evaluate the BFN Unit 1 limit curves prepared in item (a)3 above based on new MSL strain gauge data collected following the BFN Unit 1 EPU outage at or near 3458 MWt. If the limit curves change, the new post-EPU outage limit curves shall be provided to the NRC Project Manager. TVA shall not increase power above 3458 MWt for at least 96 hours after the NRC Project Manager confirms receipt of the reports unless, prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

5. TVA shall monitor the MSL strain gauges during power ascension above 3458 MWt for increasing pressure fluctuations in the steam lines. Upon the initial increase of power above 3458 MWt until reaching 3952 MWt, TVA shall collect data from the MSL strain gauges at nominal 2.5% of 3458 MWt (approximately 86 MWt) increments and evaluate steam dryer performance based on this data.

6. During power ascension at each nominal 2.5 percent power level above 3458 MWt (approximately 86 MWt), TVA shall compare the MSL data to the approved limit curves based on end-to-end B/Us from the BFN Unit 3 benchmarking at EPU conditions and determine the MASR.

7. TVA shall hold the facility at approximately 3630 MWt and 3803 MWt to perform the following:

   a. Collect strain data from the MSL strain gauges.

   b. Collect vibration data for the locations included in the vibration summary report discussed above.

   c. Evaluate steam dryer performance based on MSL strain gauge data.

   d. Evaluate the measured vibration data (collected in item 7.b above) at that power level, data projected to EPU conditions, trends, and comparison with the acceptance limits.

e. Provide the steam dryer evaluation and the vibration evaluation, including the data collected, to the NRC Project Manager, upon completion of the evaluation for each of the hold points.

f. TVA shall not increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the evaluations unless, prior to the expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

8. If any frequency peak from the MSL strain gauge data exceeds the Level 1 limit curves, TVA shall return the facility to a power level at which the limit curve is not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. If a revised stress analysis is performed and new limit curves are developed, then TVA shall not further increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the documentation or until the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension, whichever comes first. Additional detail is provided in item (b)1 below.

(b) TVA shall implement the following actions for the initial power ascension from 3458 MWt to 3952 MWt condition:

1. In the event that acoustic signals (in MSL strain gauge signals) are identified that exceed the Level 1 limit curves during power ascension above 3458 MWt, TVA shall re-evaluate dryer loads and stresses, and re-establish the limit curves. In the event that stress analyses are re-performed based on new strain gauge data to address item (a)7 above, the revised load definition, stress analysis, and limit curves shall include:

   a. Application of end-to-end B/Us as determined from BFN Unit 3 EPU measurements.

   b. Use of scaling factors associated with all of the SRV acoustic resonances as estimated in the predictive analysis or in-plant data acquired during power ascension.

2. After reaching 3952 MWt, TVA shall obtain measurements from the MSL strain gauges and establish the steam dryer flow-induced vibration load fatigue margin for the facility and update the steam dryer stress report. These data will be provided to the NRC staff as described below in item (e).

(c) TVA shall prepare the EPU PAT Plan to include the following.

1. The MSL strain gauge limit curves to be applied for evaluating steam dryer performance, based on end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions.

2. Specific hold points and their durations during EPU power ascension.

3. Activities to be accomplished during the hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters, and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the application and all supplements to the application in support of the EPU license amendment request pertaining to the steam dryer prior to power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval:

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made in accordance with the guidance of NEI 99-04, “Guidelines for Managing NRC Commitments,” issued July 1999.

(e) Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions. The report shall be submitted to NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 1. Should the results of this stress analysis indicate the allowable stress in any part of the steam dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the steam dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of steam dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

(f) Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 1. The vibration summary report shall include the information in items (f)1 through (f)3, as follows:

1. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015, including the identified locations associated with MSLs, Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

2. An evaluation of the measured vibration data collected in item (f)1 above compared against acceptance limits.

3. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item (f)1, above.

(g) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(h) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted to the NRC within 90 days following startup from each of the first two respective refueling outages.

(i) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in items (g) and (h), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in item (i).

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than December 20, 2013, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

F. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of the most recent NRC-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) appropriate for the configuration of the specimens in the capsule. Any changes to the BWRVIP ISP capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC, as required by 10 CFR Part 50, Appendix H.

G. (1) During the power uprate power ascension test program and prior to exceeding 30 days of plant operation above a nominal 3293 megawatts thermal power level (100-percent OLTP) or within 30 days of satisfactory completion of steam dryer monitoring and testing that is necessary for achieving 105-percent OLTP (whichever is longer), with plant conditions stabilized at 105-percent OLTP, TVA

shall trip a condensate booster pump, a condensate pump, and a main feedwater pump on an individual basis (i.e., one at a time). Following each pump trip, TVA shall confirm that plant response to the transient is as expected in accordance with previously established acceptance criteria. Evaluation of the test results for each test shall be completed and all discrepancies resolved in accordance with corrective action program requirements and the provisions of the power ascension test program.

(2) Deleted.

H. The licensee must complete the thirteen (13) Unit 1 restart commitments that are discussed in Appendix F of the license renewal application, dated December 31, 2003, as supplemented by letters dated January 31, 2005, March 2, and April 21, 2006. Completion of these activities must be met prior to power operation of Unit 1.

I. This renewed license is effective as of the date of issuance and shall expire midnight on December 20, 2033.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By
J. E. Dyer
J. E. Dyer
Office of Nuclear Reactor Regulation

Attachments:
1. Unit 1 - Technical Specifications - Appendices A and B

Date of Issuance: May 4, 2006

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and

c. A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

(continued)

5.5 Programs and Manuals

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9);
- Gaseous Fire Suppression Systems (Section 3.10); and
- Passive Fire Protection Features (Section 3.11).

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC Safety Evaluation dated October 28, 2015, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the following modifications to its facility, as described in Table S-2, "Plant Modifications," of Tennessee Valley Authority letter CNL-15-191, dated September 8, 2015, to complete the transition to full compliance with 10 CFR 50.48(c) no later than the end of the second refueling outage (for each unit) following issuance of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-116-165, dated October 31, 2016, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(14) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analyses Report (UFSAR).

(15) Upon implementation of Amendment No. 275, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.3.4, in accordance with TS 5.5.13.c(i), the assessment of the CRE habitability as required by TS 5.5.13.c(ii), and the measure of CRE pressure as required by TS 5.5.13.d, shall be considered met.

Following implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c(ii), shall be within 9 months following the initial implementation of the TS change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be with 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

(17) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, "AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0," (i.e., TS 5.6.5.b.10) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 311.

(18) **Potential Adverse Flow Effects**

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 2 steam dryer testing. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up.

2. TVA shall monitor the main steam line (MSL) strain gauges at a minimum of three power levels up to 3458 MWt. If the number of active MSL strain gauges is less than two strain gauges (180 degrees apart) at any of the eight MSL locations, TVA will stop

power ascension and repair/replace the damaged strain gauges and only then resume power ascension.

3. At least 90 days prior to the start of the BFN Unit 2 EPU outage, TVA shall revise the BFN Unit 2 replacement steam dryer (RSD) analysis utilizing the BFN Unit 3 on-dryer strain gauge based end-to-end Bias errors and Uncertainties (B/Us) at EPU conditions, and submit the information including the updated limit curves and a list of dominant frequencies for BFN Unit 2, to the NRC as a report in accordance with 10 CFR 50.4.

   a. If the on-dryer instrumentation was not available when BFN Unit 3 reached a power level of 3458 MWt and the BFN-specific bias and uncertainty data and transfer function could not be developed, the predicted dryer loads during the BFN Unit 2 power ascension will be calculated with the Plant Based Load Evaluation Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will be based on BFN Unit 3 steam dryer confirmatory stress analysis results using the MSL strain gauge data collected at EPU conditions. The acceptance limits will ensure the steam dryer stress margins remain above the minimum alternating stress ratio (MASR) determined in the BFN Unit 3 steam dryer EPU confirmatory analyses.

4. TVA shall evaluate the BFN Unit 2 limit curves prepared in item (a)3 above based on new MSL strain gauge data collected following the BFN Unit 2 EPU outage at or near 3458 MWt. If the limit curves change, the new post-EPU outage limit curves shall be provided to the NRC Project Manager. TVA shall not increase power above 3458 MWt for at least 96 hours after the NRC Project Manager confirms receipt of the reports unless, prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

5. TVA shall monitor the MSL strain gauges during power ascension above 3458 MWt for increasing pressure fluctuations in the steam lines. Upon the initial increase of power above 3458 MWt until reaching 3952 MWt, TVA shall collect data from the MSL strain gauges at nominal 2.5% of 3458 MWt (approximately 86 MWt) increments and evaluate steam dryer performance based on this data.

6. During power ascension at each nominal 2.5 percent power level above 3458 MWt (approximately 86 MWt), TVA shall compare the MSL data to the approved limit curves based on end-to-end B/Us from the BFN Unit 3 benchmarking at EPU conditions and determine the MASR.

7. TVA shall hold the facility at approximately 3630 MWt and 3803 MWt to perform the following:

   a. Collect strain data from the MSL strain gauges.

   b. Collect vibration data for the locations included in the vibration summary report discussed above.

   c. Evaluate steam dryer performance based on MSL strain gauge data.

   d. Evaluate the measured vibration data (collected in item 7.b above) at that power level, data projected to EPU conditions, trends, and comparison with the acceptance limits.

   e. Provide the steam dryer evaluation and the vibration evaluation, including the data collected, to the NRC Project Manager, upon completion of the evaluation for each of the hold points.

   f. TVA shall not increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the evaluations unless, prior to the expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension.

8. If any frequency peak from the MSL strain gauge data exceeds the Level 1 limit curves, TVA shall return the facility to a power level at which the limit curve is not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. If a revised stress analysis is performed and new limit curves are developed, then TVA shall not further increase power above each hold point until 96 hours after the NRC Project Manager confirms receipt of the documentation or until the NRC Project Manager advises that the NRC staff has no objections to the continuation of power ascension, whichever comes first. Additional detail is provided in item (b)1 below.

(b) TVA shall implement the following actions for the initial power ascension from 3458 MWt to 3952 MWt condition:

1. In the event that acoustic signals (in MSL strain gauge signals) are identified that exceed the Level 1 limit curves during power ascension above 3458 MWt, TVA shall re-evaluate dryer loads and stresses, and re-establish the limit curves. In the event that stress analyses are re-performed based on new strain gauge data to address item (a)7 above, the revised load definition, stress analysis, and limit curves shall include:

   a. Application of end-to-end B/Us as determined from BFN Unit 3 EPU measurements.

   b. Use of scaling factors associated with all of the SRV acoustic resonances as estimated in the predictive analysis or in-plant data acquired during power ascension.

2. After reaching 3952 MWt, TVA shall obtain measurements from the MSL strain gauges and establish the steam dryer flow-induced vibration load fatigue margin for the facility and update the steam dryer stress report. These data will be provided to the NRC staff as described below in item (e).

(c) TVA shall prepare the EPU PAT Plan to include the following.

1. The MSL strain gauge limit curves to be applied for evaluating steam dryer performance, based on end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions.

2. Specific hold points and their durations during EPU power ascension

3. Activities to be accomplished during the hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters, and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the application and all supplements to the application in support of the EPU license amendment request pertaining to the steam dryer prior to power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval:

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made accordance with the guidance of NEI 99-04, "Guidelines for Managing NRC Commitments," issued July 1999.

(e) Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us from BFN Unit 3 benchmarking at EPU conditions. The report shall be submitted to NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 2. Should the results of this stress analysis indicate the allowable stress in any part of the steam dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the steam dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of steam dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

(f) Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 2. The vibration summary report shall include the information in items (f)1 through (f)3, as follows:

1. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015,

including the identified locations associated with MSLs, Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

2. An evaluation of the measured vibration data collected in item (f)1 above compared against acceptance limits.

3. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item f(1), above.

(g) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(h) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted within 90 days following startup from each of the first two respective refueling outages.

(i) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in items (g) and (h), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in item (i).

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than June 28, 2014, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

F. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of the most recent NRC-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated

. Surveillance Program (ISP) appropriate for the configuration of the specimens in the capsule. Any changes to the BWRVIP ISP capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC, as required by 10 CFR Part 50, Appendix H

G. This renewed license is effective as of the date of issuance and shall expire midnight on June 28, 2034.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By
J. E. Dyer
J. E. Dyer, Director
Office of Nuclear Reactor Regulation

Attachments:
1. Unit 2 - Technical Specifications - Appendices A and B

Date of Issuance: May 4, 2006

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and

c. A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

(continued)

5.5 Programs and Manuals

5.5.14 Residual Heat Removal (RHR) Heat Exchange Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

3. The licensee shall complete the implementation items as listed in Table S-3, "Implementation Items," of Tennessee Valley Authority letters CNL-15-191, dated September 8, 2015, and CNL-116-165, dated October 31, 2016, within 240 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation items 32 and 33 are associated with modifications and will be completed after all procedure updates, modifications, and training are complete.

(8) Deleted.

(9) The licensee shall maintain the Augmented Quality Program for the Standby Liquid Control System to provide quality control elements to ensure component reliability for the required alternative source term function defined in the Updated Final Safety Analyses Report (UFSAR).

(10) Mitigation Strategy License Condition

Develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

(a) Fire fighting response strategy with the following elements:
   1. Pre-defined coordinated fire response strategy and guidance
   2. Assessment of mutual aid fire fighting assets
   3. Designated staging areas for equipment and materials
   4. Command and control
   5. Training of response personnel

(b) Operations to mitigate fuel damage considering the following:
   1. Protection and use of personnel assets
   2. Communications
   3. Minimizing fire spread
   4. Procedures for implementing integrated fire response strategy
   5. Identification of readily-available pre-staged equipment
   6. Training on integrated fire response strategy
   7. Spent fuel pool mitigation measures

(c) Actions to minimize release to include consideration of:
   1. Water spray scrubbing
   2. Dose to onsite responders

(11) The licensee shall implement and maintain all Actions required by Attachment 2 to NRC Order EA-06-137, issued June 20, 2006, except the last action that requires incorporation of the strategies into the site security plan, contingency plan, emergency plan and/or guard training and qualification plan, as appropriate.

(12) Upon completion of Amendment No. 261, adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.3.4, in accordance with TS 5.5.13.c(i), the assessment of the CRE habitability as required by TS 5.5.13.c(ii), and the measurement of the CRE pressure as required by TS 5.5.13.d, shall be considered met.

Following Implementation:

(a) The first performance of SR 3.7.4.4, in accordance with TS 5.5.13.c.(i), shall be within a specific frequency of 6 years, plus the 18-month allowance of SR 3.0.2, as measured from November 10, 2003, the date of the most recent successful tracer gas test.

(b) The first performance of the periodic assessment of the Control Room Envelope (CRE) Habitability, Technical Specification 5.5.13.c.(ii), shall be within 9 months following the initial implementation of the TS Change. The next performance of the periodic assessment will be in a period specified by the CRE Program. That is 3 years from the last successful performance of the Technical Specification 5.5.13.c.(ii) tracer gas test.

(c) The first performance of the periodic measurement of CRE pressure, TS 5.5.13.d, shall be within 24 months, plus 180 days allowed by SR 3.0.2 as measured from the date of the most recent successful pressure measurement test.

(d) For License Amendment 268, the licensee shall implement changes to BFN, Unit 3 TSs 5.6.5 and 3.3.1.1 within 60 days of approval. The remaining BFN, Unit 3, changes will be implemented upon completion of required supporting modification work and prior to entering Mode 3 (i.e., Hot Shutdown) from the spring 2014 refueling outage.

(13) The fuel channel bow standard deviation component of the channel bow model uncertainty used by ANP-10307PA, “AREVA MCPR Safety Limit Methodology for Boiling Water Reactors, Revision 0,” (i.e., TS 5.6.5.b.10) to determine the Safety Limit Minimum Critical Power Ratio shall be increased by the ratio of channel fluence gradient to the nearest channel fluence gradient bound of the channel measurement database, when applied to channels with fluence gradients outside the bounds of the measurement database from which uncertainty is determined. This license condition will be effective upon the implementation of Amendment No. 270.

(14) **Potential Adverse Flow Effects**

This license condition provides for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of power uprate operation on plant structures, systems, and components (including verifying the continued structural integrity of the steam dryer) for initial power ascension from the 3458 MWt to the EPU level of 3952 MWt.

(a) The following requirements are placed on operation of the facility before and during the initial power ascension to 3458 MWt:

1. TVA shall provide a Power Ascension Test (PAT) Plan for the BFN Unit 3 steam dryer testing. This plan shall include:

   a. Criteria for comparison and evaluation of projected strain and acceleration with on-dryer instrument data.

   b. Acceptance limits developed for each on-dryer strain gauge.

   c. Tables of predicted dryer stresses at a power level of 3458 MWt, strain amplitudes and PSDs at strain gauge locations, and maximum stresses and locations.

   The PAT plan shall provide correlations between measured strains and the corresponding maximum stresses. The PAT plan shall be submitted to the NRC Project Manager no later than 10 days before start-up.

2. TVA shall monitor the main steam line (MSL) strain gauges and on-dryer instrumentation at a minimum of three power levels up to 3458 MWt. Based on a comparison of projected and measured strains and accelerations, BFN will assess whether the dryer acoustic and structural models have adequately captured the response significant to peak stress projections. If the measured strains and accelerations are not within the 3458 MWt acceptance limits, the new measured data will be used to re-perform the full structural re-analysis for the purposes of generating modified EPU acceptance limits.

   a. If the on-dryer instrumentation is unavailable, the BFN Unit 3 power ascension will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the Plant Based Load Evaluation (PBLE) Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will ensure that the steam dryer stress margins remain above the final minimum alternating stress ratio (MASR) accepted in the EPU design analyses.

3. BFN shall provide a summary of the data and evaluation of predicted and measured pressures, strains, and accelerations at a power level of 3458 MWt. This data will include the BFN-specific bias and uncertainty data and transfer function, revised peak stress table and any revised acceptance limits. The predicted pressures shall include those using both PBLE methods (that is, Method 1 using on-dryer data, and Method 2 using MSL data). It shall be provided to the NRC Project Manager upon completion of the evaluation. TVA shall not increase power above 3458 MWt until the NRC PM notifies TVA that NRC accepts the evaluation or NRC questions regarding the evaluation have been addressed. If no questions are identified within 240 hours after the NRC receives the evaluation, power ascension may continue.

   a. If the on-dryer instrumentation is unavailable and the BFN-specific bias and uncertainty data and transfer function cannot be developed when BFN Unit 3 reaches a power level of 3458 MWt, the BFN Unit 3 power ascension above 3458 MWt will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the PBLE Method 2 transfer function used in the steam dryer design analyses for EPU. The acceptance limits will ensure that the steam dryer stress margins remain above the final MASR accepted in the EPU design analyses.

(b) The following requirements are placed on operation of the facility during the initial power ascension from 3458 MWt to the approved EPU level (3952 MWt):

1. At test increments that do not exceed 2.5% of 3458 MWt (approximately 86 MWt), TVA shall hold the facility at approximately steady state conditions and collect data from available MSL strain gauges and available on-dryer instrumentation. This data will be evaluated, including the comparison of measured dryer strains to acceptance limits and the comparison of predicted dryer loads based on MSL strain gauge data to acceptance limits. It will also be used to trend and project loads at the next test point and to EPU conditions to demonstrate margin for continued power ascension.

   a. If the on-dryer instrumentation becomes unavailable during power ascension above 3458 MWt, the BFN Unit 3 power ascension above 3458 MWt will be monitored using the available MSL strain gauges. The predicted dryer loads during the power ascension will be calculated with the BFN-specific PBLE Method 2 transfer function developed from the on-dryer instrumentation and MSL

strain gauge data taken at the 3458 MWt hold point, the BFN-specific bias and uncertainty data, the revised peak stresses, and revised acceptance criteria developed in item (a)3 above. The acceptance limits will maintain the steam dryer stress margins above a MASR of 1.0.

2. Following the data collection and evaluation at the plateaus at approximately 3630 MWt, 3803 MWt, and 3952 MWt, TVA shall provide a summary of the data and the evaluation performed in item (b)1 above to the NRC Project Manager. TVA shall not increase power above these power levels for up to 96 hours after the NRC Project Manager confirms receipt of the summary, unless prior to expiration of the 96 hour period, the NRC Project Manager advises that the NRC staff has no objection to continuation of power ascension.

3. Should the measured strains on the dryer exceed the Level 1 acceptance limits, or alternatively if the dryer instrumentation is not available and the projected load on the dryer from the MSL strain gauge data exceeds the Level 1 acceptance limits, TVA shall return the facility to a power level at which the limits are not exceeded. TVA shall resolve the discrepancy, evaluate and document the continued structural integrity of the steam dryer, and provide that documentation to the NRC Project Manager prior to further increases in reactor power. TVA shall not increase power for up to 96 hours to allow for NRC review and approval of the information.

   a. In the event that acoustic signals (in MSL strain gauge signals) are identified that challenge the dryer acceptance limits during power ascension above 3458 MWt, TVA shall evaluate dryer loads, and stresses, including the effect of ±10 percent frequency shift, and re-establish the acceptance limits and determine whether there is margin for continued power ascension.

   b. During power ascension above 3458 MWt, if an engineering evaluation for the steam dryer is required because a Level 1 acceptance limit is exceeded, TVA shall perform the structural analysis using the Steam Dryer Report, Appendix A methods to address frequency uncertainties up to ±10% and assure that peak responses that fall within this uncertainty band are addressed.

4. a. Following the data collection and evaluation at the EPU power level, TVA shall provide a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the BFN-specific bias and uncertainties and transfer function, to the NRC. The BFN-specific bias and uncertainties summary shall include both PBLE Method 1 and Method 2. This report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 3. Should the results of this stress analysis indicate the allowable stress in any part of the dryer is exceeded, TVA shall reduce power to a level at which the allowable stress is met, evaluate the dryer integrity, and assess any shortcomings in the predictive analysis. The results of this evaluation, including a recommended resolution of any identified issues and a demonstration of dryer integrity at EPU conditions, shall be provided to the NRC for review and approval prior to return to EPU conditions.

   b. Within 30 days after completion of the core flow sweep test at EPU conditions to determine any compounding effect due to alignment of Vane Passing Frequency and Safety Relief Valve resonance frequencies, the TVA shall provide the core flow sweep test results for NRC review.

5. Following the data collection and evaluation at the EPU power level, TVA shall provide a vibration summary report to the NRC. The summary report shall be submitted to the NRC within 90 days of the completion of EPU power ascension testing for BFN Unit 3 The vibration summary report shall include the information in items 5.a through 5.c, as follows:

   a. Vibration data for piping and valve locations deemed prone to vibration and vibration monitoring locations identified in Attachment 45 to the EPU application dated September 21, 2015, including the identified locations associated with MSLs, Feedwater Lines, Safety Relief Valves and the Main Steam Isolation Valves.

   b. An evaluation of the measured vibration data collected in item 5.a above compared against acceptance limits.

   c. Vibration values and associated acceptance limits at approximately 3630 MWt, 3803 MWt, and 3952 MWt using the data collected in item 5.a, above.

(c) TVA shall prepare the EPU PAT plan to include the following.

1. Level 1 and Level 2 acceptance limits for on-dryer strain gauges and for projected dryer loads from MSL strain gauge data to be used up to 3952 MWt.

2. Specific hold points and their duration during EPU power ascension.

3. Activities to be accomplished during hold points.

4. Plant parameters to be monitored.

5. Inspections and walkdowns to be conducted for steam, feedwater, and condensate systems and components during the hold points.

6. Methods to be used to trend plant parameters.

7. Acceptance criteria for monitoring and trending plant parameters and conducting the walkdowns and inspections.

8. Actions to be taken if acceptance criteria are not satisfied.

9. Verification of the completion of commitments and planned actions specified in the TVA application and all supplements to the application in support of the EPU LAR pertaining to the steam dryer before power increase above 3458 MWt.

10. Identify the NRC Project Manager as the NRC point of contact for providing PAT plan information during power ascension.

11. Methodology for updating limit curves.

(d) The following key attributes of the PAT Plan shall not be made less restrictive without prior NRC approval.

1. During initial power ascension testing above 3458 MWt, each of the two hold points shall be at increments of approximately 5 percent of 3458 MWt.

2. Level 1 performance criteria.

3. The methodology for establishing the limit curves used for the Level 1 and Level 2 performance.

Changes to other aspects of the PAT Plan may be made in accordance with the guidance of NEI 99-04, "Guidelines for Managing NRC Commitments," issued July 1999.

(e) During the first two scheduled refueling outages after reaching full EPU conditions, TVA shall conduct a visual inspection of all accessible, susceptible locations of the steam dryer in accordance with BWRVIP-139A (Steam Dryer Inspection and Flaw Evaluation Guidelines) and GE inspection guidelines (SIL 644, BWR Steam Dryer Integrity).

(f) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted to NRC within 90 days following startup from each of the first two respective refueling outages.

(g) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

This license condition described above shall expire: (1) upon satisfaction of the requirements in items (e) and (f) provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is caused by fatigue, and; (2) upon satisfaction of the requirements specified in item (g).

D. The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the UFSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, TVA may make changes to the programs and activities described in the supplement without prior Commission approval, provided that TVA evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

E. The UFSAR supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. TVA shall complete these activities no later than July 2, 2016, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

F. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of the most recent NRC-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) appropriate for the configuration of the specimens in the capsule. Any changes to the BWRVIP ISP capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC, as required by 10 CFR Part 50, Appendix H.

G. This renewed license is effective as of the date of issuance and shall expire midnight on July 2, 2036.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By
J. E. Dyer
J. E. Dyer, Director
Office of Nuclear Reactor Regulation

Attachments:
1. Unit 3 - Technical Specifications - Appendices A and B

Date of Issuance: May 4, 2006

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the FSAR; and

b. Fuel assemblies having a maximum k-infinity of 0.8825 in the normal spent fuel pool storage rack configuration; and

c. A nominal 6.563 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.2 of the FSAR;

b. $k_{eff} \leq 0.90$ if in a dry condition, or in the absence of moderator, as described in Section 10.2 of the FSAR; and

c. A nominal 6.625 inch center to center distance between fuel assemblies placed in storage racks.

(continued)

5.5 Programs and Manuals

5.5.14 Residual Heat Removal (RHR) Heat Exchanger Performance Monitoring Program

This program is established to ensure that the RHR heat exchangers are maintained in a condition that meets or exceeds the minimum performance capability assumed in containment analyses, which support not taking credit for containment accident pressure in the NPSH analyses. The RHR heat exchanger testing and determination of overall uncertainty in the fouling resistance shall be in accordance with the guidelines in EPRI report, EPRI 3002005340, Service Water Heat Exchanger Test Guidelines, May 2015. This program establishes the following attributes.

a. The program establishes provisions to periodically monitor RHR heat exchanger thermal performance. The program includes frequency of monitoring and the methodology considers uncertainty of the result.

b. The program establishes and controls acceptance criteria for RHR heat exchanger worst fouling resistance and number of plugged tubes.

c. The program establishes limitations and allows for compensatory actions if degraded performance is observed.

d. Changes to the program shall be made under appropriate administrative review.

e. Details of the program including program limitations, compensatory actions for degraded performance, testing method, data acquisition method, data reduction method, overall uncertainty determination method, thermal performance analysis, acceptance criteria, and computer programs used that meet the 10 CFR 50 Appendix B, and 10 CFR 21 requirements are described in the UFSAR.

ENCLOSURE 4

Update to Table S-3 Implementation Item 49
of
TVA letter CNL-15-224, dated October 20, 2015

Table S-3 Implementation Items

Item	Unit	Description	LAR Section / Source
43	1,2,3	Revise the procedure NPG-SPP-18.4.8, Control of Ignition Sources (Hot Work), to incorporate corrective actions identified in MDQ0009992013000160.	4.1 and Attachment A, 3.3.1.3.1
45	1,2,3	Revise procedures NPG-SPP-18.4.7, Control of Transient Combustibles, and NPG-SPP-18.4.8, Control of Ignition Sources (Hot Work), to strengthen risk and defense in-depth administrative controls (e.g., no storage and no hot work designated areas).	Attachment C and V
46	1,2,3	Verification of the condition of electrical cabinet doors to meet Fire Modeling Assumptions will be included in the monitoring Program.	Response to RAI PRA 01.d.i
47	1,2,3	Perform a focused-scope peer review of the Fire PRA. The peer review will include, as a minimum, the following elements: Fire PRA Cable Selection and Location (CS), Human Reliability Analysis (HRA), Fire Risk Quantification (FQ), Uncertainty and Sensitivity Analysis (UNC), Accident Sequence Analysis (AS), and LERF Analysis (element LE-C6). Any focused scope peer review Finding level Facts and Observations (F&Os) will be resolved prior to self-approval of post-transition changes.	Response to RAI PRA 11.a, b and c, PRA RAI 23.d and PRA RAI 24 Part b
48	1,2,3	Develop and deliver training to Fire Operations on incipient detection systems alarm response procedures.	Response to FPE RAI 10, Revision 1
~~49~~	~~1,2,3~~	~~Revise the program that monitors BFN Residual Heat Removal (RHR) heat exchanger performance for consistency with the assumptions of the NFPA 805 Net Positive Suction Head (NPSH) analysis. The monitoring program shall include verification that the tested worst fouling resistance, with measurement uncertainty added, of all BFN Units 1, 2, and 3 RHR heat exchangers is less than the design value of 0.001517 hr ft^2-°F/BTU and the worst tube plugging is less than 4.57 percent.~~	~~Attachment X / NRC electronic mail from F. Saba (NRC) to G. Williams (TVA) and C. Szabo (TVA), "Browns Ferry NFPA 805 LAR," dated June 10, 2015 / NRC electronic mail from F. Saba (NRC) to G. Williams (TVA), C. Szabo (TVA), and E. Schrull (TVA), "NFPA 805 Draft SE Issues regarding to implementation 49," dated October 14, 2015~~