1101 Market Street, Chattanooga, Tennessee 37402

CNL-18-018

February 15, 2018

10 CFR 50.90

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

Watts Bar Nuclear Plant, Units 1 and 2
Facility Operating License Nos. NPF-90 and NPF-96
NRC Docket Nos. 50-390 and 50-391

Subject: **Supplement to Application to Revise Watts Bar Unit 2 Technical Specification 4.2.1, "Fuel Assemblies," and Watts Bar Units 1 and 2 Technical Specifications Related to Fuel Storage (WBN-TS-17-028)**

References:

1. TVA Letter to NRC, CNL-17-144, "Application to Revise Watts Bar Unit 2 Technical Specification 4.2.1, 'Fuel Assemblies,' and Watts Bar Units 1 and 2 Technical Specifications Related to Fuel Storage (WBN-TS-17-028)," dated December 20, 2017 (ML17354B282)

2. NRC letter to TVA, "Watts Bar Nuclear Plant, Units 1 and 2-Supplemental Information Needed for Acceptance of Requested Licensing Action Re: Amendment to Revise Technical Specification 4.2.1 and Technical Specifications Related to Fuel Storage (EPID L-2017-LLA-0427)," dated February 6, 2018 (ML18031A659)

In Reference 1, Tennessee Valley Authority (TVA) submitted a request for amendments to Facility Operating License Nos. NPF-90 and NPF-96 for the Watts Bar Nuclear Plant (WBN), Units 1 and 2. The proposed change revises WBN Unit 2 Technical Specification (TS) 4.2.1, "Fuel Assemblies," to allow TVA to insert Tritium Producing Burnable Absorber Rods (TPBARs) into the WBN Unit 2 reactor core, similar to WBN Unit 1, and to add a limit on the TPBARs that can be irradiated. Reference 1 also provided proposed changes to the WBN Units 1 and 2 TS related to the new criticality analyses performed for the spent fuel storage racks.

During the acceptance review of Reference 1, NRC determined that supplemental information was needed (Reference 2) and requested that TVA respond by February 16, 2018.

Enclosure 1 to this letter responds to the NRC request for supplemental information. Enclosure 2 provides a supplement to Reference 1 based on the information in Enclosure 1. Specifically, TVA is providing a new Section 4.3 to the LAR submitted in Reference 1 that describes each of the proposed TS changes and their basis.

The supplement in Enclosure 2 does not change the no significant hazards consideration or the environmental considerations contained in the referenced letter. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosures to the Tennessee Department of Environment and Conservation .

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 15th day of February 2018.

Respectfully,

J. W. Shea
Vice President, Nuclear Regulatory Affairs and Support Services

Enclosures:

1. Response to the NRC Request for Supplemental Information
2. Supplemental Information Regarding the TPBAR Submittal

cc (Enclosures):

NRC Regional Administrator - Region II
NRC Resident Inspector – Watts Bar Nuclear Plant
NRC Project Manager – Watts Bar Nuclear Plant
Director, Division of Radiological Health - Tennessee State Department of Environment and Conservation

Tennessee Valley Authority
Response to the NRC Request for Supplemental Information

NRC Request for Supplemental Information

1. Technical Specification Changes

“Enclosure 1 of the application does not contain a sufficient description or justification for the proposed changes to the Technical Specifications (TSs). The application should be supplemented to provide a concise description of the changes to Watts Bar Nuclear Plant (Watts Bar), Unit 1, TSs 3.7.15, 3.7.18, 3.9.9, 4.3, and 5.7.2.21, and Watts Bar, Unit 2, TSs 3.7.15, 3.7.18, 3.9.9, 4.2.1, 4.3, and 5.7.2.21, and sufficient information regarding the rationale for the changes.”

TVA Response

Enclosure 2 to this letter supplements the information in the referenced letter by providing a new Section 4.3 that describes each proposed TS change and its basis.

Reference

TVA Letter to NRC, CNL-17-144, “Application to Revise Watts Bar Unit 2 Technical Specification 4.2.1, ‘Fuel Assemblies,’ and Watts Bar Units 1 and 2 Technical Specifications Related to Fuel Storage (WBN-TS-17-028),” dated December 20, 2017 (ML17354B282)

NRC Request for Supplemental Information

2. Application Enclosure 1, Section 4.1.4, Reactor Vessel Integrity Analysis

“The U.S. Nuclear Regulatory Commission (NRC) staff performed a preliminary review of WCAP-18191-NP, Revision 0, "Watts Bar Unit 2 Heatup and Cooldown Limit Curves for Normal Operation and Supplemental Reactor Vessel Integrity Evaluations" (May 2017), provided as Enclosure 2 to the application. Table E-1 of WCAP-18191-NP reports a limiting inside surface neutron fluence for the reactor pressure vessel (RPV) at 32 effective full-power years (EFPY) of 1.861 E+19 n/cm2 for neutron energy (E) greater than 1 MeV. The NRC staff also reviewed report WCAP-17305-NP, Revision 2, "Watts Bar Unit 2 Heatup and Cooldown Limit Curves for Normal Operation and PTLR Support Documentation" (December 2009), referenced in Enclosure 2 of the application. In Table C-1 of WCAP-17035-NP, Tennessee Valley Authority reported that the limiting inside surface neutron fluence for the RPV at 32 EFPY was 3.17E+19 n/cm2 for neutron energy greater than 1 MeV. The WCAP-18191-NP value for neutron fluence (with tritium producing burnable absorber rods) is over 40 percent less than the value of neutron fluence from the WCAP-17035-NP report, which the staff considers significant. The NRC staff observes that both the WCAP-18191-NP and WCAP-17035-NP analyses use the same methodology as in WCAP-14040-A, Revision 2, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," and in accordance with Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." The WCAP-18191-NP report indicates that Tennessee Valley Authority used the DORT code with coupled BUGLE-96 cross-section library, whereas WCAP-17035-NP did not report which code and libraries were used.

In view of the significant discrepancy between the fluence results from WCAP-18191-NP and WCAP-17035-NP for Watts Bar, Unit 2, the NRC staff requires further explanation regarding the change in the reported inside surface neutron fluence for the RPV at 32 EFPY in order to complete its acceptance review of this section."

TVA Response

WCAP-17035-NP was created in December 2009, which is prior to the licensing of WBN Unit 2 (October 22, 2015). The neutron fluence values provided in WCAP-17035-NP were based on a design basis core power distribution that assumed an out/in core loading strategy for the entire operating lifetime of the reactor. Because essentially all plants transition to some form of low leakage fuel management relatively early in life, it was expected that the neutron fluence with an out/in core loading scheme would bound any practical mode of operation.

Because WBN Unit 2 is now an operating plant, actual power distributions are now available. Therefore, Regulatory Guide 1.190 recommends that these plant specific power distributions be used to calculate best estimate fluence calculations. The fluence values provided in WCAP-18191-NP were based on these newer power distributions. In the case of WBN Unit 2, the actual power in the peripheral fuel assemblies calculated for WCAP-18191-NP is less than that used in the WCAP-17035-NP calculation. This reduction in peripheral power, relative to the design basis, results in a decrease in neutron flux at the inside surface of the reactor pressure vessel (RPV). The reduction in peripheral power overrides the effect of the inclusion of the TPBARs. The net effect is a reduction in the projected best estimate fluence experienced by the RPV wall.

Both WCAP-18191-NP and WCAP-17035-NP reference WCAP-14040-A, Revision 4 (ML050120209), which states "All of the transport calculations are carried out using the DORT discrete ordinates code Version 3.1 and the BUGLE-96 cross-section library."

A comparison of the radial power distribution of Cycle 7 in WCAP-18191 (i.e., a low-leakage pattern) and the radial power distribution used in WCAP-17035 (i.e., an out/in pattern) shows that the average of the peripheral assemblies (as shown in bold red italics in Tables 1 and 2) in Cycle 7 of WCAP-18191 is 0.590, while that contained in WCAP-17035 is 0.971. The average of the peripheral assemblies was based on those assemblies that are on the outermost periphery of the core and are the closest assemblies to the RPV (see those assemblies in bold italics in Tables 1 and 2)." Because the peripheral assemblies drive the fluence, this shows the large difference in fluence results between the WCAPs. Table 1 shows the ¼ core average radial power distribution used in WCAP-18191; Table 2 shows the ¼ core average radial power distribution used in WCAP-17035.

Table 1 - Low Leakage Pattern used in WCAP-18191 for Cycle 7

Relative Power							
0.967	1.059	1.197	1.158	1.224	1.130	1.203	0.683
1.059	1.102	1.139	1.205	1.148	1.183	1.065	***0.655***
1.197	1.138	1.214	1.141	1.170	1.115	1.193	***0.646***
1.158	1.202	1.138	1.155	1.100	1.118	0.919	***0.489***
1.224	1.144	1.170	1.101	1.124	1.0396	***0.702***	
1.130	1.181	1.113	1.117	1.039	0.902	***0.415***	
1.203	1.062	1.191	0.916	***0.700***	***0.415***		
0.683	***0.653***	***0.646***	***0.488***				
Average of Peripheral Assemblies =							0.59

Table 2 - Out-In Pattern used in WCAP-17035

Relative Power							
0.86	1.07	0.87	0.90	1.09	1.05	1.02	1.06
1.07	1.06	0.94	1.04	1.06	0.87	1.10	***1.09***
0.87	0.94	1.09	1.12	0.88	0.87	1.00	***1.01***
0.90	1.04	1.12	0.92	1.10	1.07	1.05	***0.81***
1.09	1.06	0.88	1.10	1.04	1.00	***1.15***	
1.05	0.87	0.87	1.07	1.00	1.05	***0.75***	
1.02	1.10	1.00	1.05	***1.15***	***0.75***		
1.06	***1.09***	***1.01***	***0.81***				
Average of Peripheral Assemblies =							0.97

Isolating the effect of TPBARs on the fluence is difficult because many factors contribute to the fluence on a cycle to cycle basis (e.g., loading pattern, assembly-wise fuel enrichment, assembly-wise burnup history, prior operating cycle history). The average peripheral power in Cycle 3 is 0.372 while that of Cycle 4 increases to 0.498. Cycle 3 includes zero TPBARs while Cycle 4 begins the implementation of TPBARs. The maximum RPV flux increases from 1.351E10 n/cm^2-s to 1.687E10 n/cm^2-s between Cycle 3 and Cycle 4. Furthermore, the maximum RPV flux further increases in Cycle 5 to about 1.95E10 n/cm^2-s through Cycle 7. The number of TPBARs is increased in each cycle from Cycle 4 through Cycle 7. While these increases in maximum RPV flux cannot be solely associated with the implementation of TPBARs, the anticipated loading patterns including TPBARs (Cycles 4 through7) will impart a greater maximum flux on the reactor vessel than Cycle 3 which does not include TPBARs.

Note that it is not appropriate to compare Cycles 1 and 2 to other cycles because neither of them includes twice burned assemblies, as Cycles 3 through 7 will.

4.3 Technical Specification Changes

The following subsections describe each proposed Technical Specification (TS) and its basis.

4.3.1 TS 3.7.15 Spent Fuel Pool Assembly Storage

WBN Units 1 and 2 TS 3.7.15 is revised to reflect that the new Spent Fuel Pool (SFP) criticality control parameters are based on the maximum allowed fuel assembly enrichment and SFP boron concentration. The TS 3.7.15 title is revised to better align with Standard Technical Specifications (STS) 3.7.17 for Westinghouse Plants, Revision 4.0 (NUREG-1431). The Limiting Condition for Operation (LCO) for TS 3.7.15 is revised to delete the previous fuel assembly criticality control parameter that was based on spent fuel assembly burnup and reflect that the new fuel assembly technical basis for criticality control is centered on the initial enrichment of the new and spent fuel assembles in the SFP. Surveillance Requirement (SR) 3.7.15.1 is revised to delete the previous criticality control parameter that was based on spent fuel assembly burnup. The new controls are based on the maximum allowed fuel assembly enrichment and SFP boron concentration specified in TS 4.3.1.1. The analysis of SFP criticality is described in Section 4.1.10 of the TPBAR license amendment request (LAR) (Reference 1) and in Holtec Report No: 2177876, “Licensing Report for the Criticality Safety Analysis of the Watts Bar Nuclear Plant Spent Fuel Pool” (see Enclosure 3 to Reference 1).

4.3.2 TS 3.7.18 Fuel Storage Pool Boron Concentration

WBN Units 1 and 2 TS 3.7.18 is added to reflect that the new technical basis for criticality control is centered around the boron concentration of the SFP. The new TS is based on TS 3.7.16 from the STS. The 2,300 ppm limit is based on the boron dilution analysis required by the NEI 12-16 methodology as discussed in Section 4.1.10 of Reference 1 and Holtec Report No: 2177876. STS 3.7.16 is modified to delete the verification actions that are associated with spent fuel assembly burnup controls. The STS SR 3.7.16 frequency is reduced from seven days to 72 hours to be consistent with the existing WBN Units 1 and 2 SR 3.9.9.1.

4.3.3 TS 3.9.9 Spent Fuel Pool Boron Concentration

WBN Units 1 and 2 TS 3.9.9 is revised to reflect that the new technical basis for criticality control is centered around the boron concentration of the SFP. The LCO for TS 3.9.9 is revised to reflect the 2,300 ppm initial condition assumption in the boron dilution analysis, which is required by the NEI 12-16 methodology when credit for boron is used, as discussed in Section 4.1.10 of Reference 1 and Holtec Report No: 2177876. The Applicability for TS 3.9.9 is revised to reflect the new criticality controls that are based on the SFP boron concentration, which apply whenever fuel is stored in the SFP. The Action for TS 3.9.9 is revised to reflect the new criticality controls that are based on the SFP boron concentration. SR 3.9.9.1 is revised to reflect the 2,300 ppm initial condition assumption in the boron dilution analysis and to revise the surveillance frequency, which now apply whenever fuel is stored in the SFP.

4.3.4 TS 4.2.1 Fuel Assemblies (WBN Unit 2 only)

WBN Unit 2 TS 4.2.1 is revised to add a discussion of the maximum of TPBARs authorized to be placed into the reactor in an operating cycle. This change is consistent with the existing WBN Unit 1 TS 4.2.1.

4.3.5 TS 4.3.1 Criticality

WBN Units 1 and 2 TS 4.3.1.1 is revised to reflect the new SFP criticality controls that are based on the maximum allowed fuel assembly enrichment and SFP boron concentration. TS 4.3.1.1.a is modified to add details regarding fuel enrichment limits previously contained in TS 4.3.1.1.d. TS 4.3.1.1.b is revised to reflect the 2,300 ppm initial condition assumption in the boron dilution analysis, which is required by the NEI 12-16 methodology, as discussed in Section 4.1.10 of Reference 1 and Holtec Report No: 2177876. TS 4.3.1.1.d along with Figures 4.3-3 and 4.3-4 are deleted to reflect the new SFP criticality controls that are no longer based on spent fuel assembly burnup or integral burnable absorber credit. The last paragraph of TS 4.3.1 is revised to reflect the conditions of the new criticality analysis.

4.3.6 TS 5.7.2.21 Spent Fuel Storage Rack Neutron Absorber Monitoring Program

WBN Units 1 and 2 TS 5.7.2.21 is added to provide administrative controls in accordance with 10 CFR 50.36(c)(5) regarding the Neutron Absorber Monitoring Program discussed in Section 4.1.10 of Reference 1. As noted in Section 4.1.10 of Reference 1, the Neutron Absorber Monitoring Program is consistent with the NRC-approved guidance in Reference 2.

<u>References</u>

1. TVA Letter to NRC, CNL-17-144, “Application to Revise Watts Bar Unit 2 Technical Specification 4.2.1, ‘Fuel Assemblies,’ and Watts Bar Units 1 and 2 Technical Specifications Related to Fuel Storage (WBN-TS-17-028),” dated December 20, 2017 (ML17354B282)
2. NEI 16-03-A, “Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools,” Revision 0, dated May 2017 (ML17263A133)