December 31, 2008

TVA-WBN-TS-08-04 10 CFR 50.90

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

Gentlemen:

In the Matter of) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - REVISED TECHNICAL SPECIFICATIONS CHANGE WBN-TS-08-04 – REVISION TO THE MAXIMUM NUMBER OF TPBARS THAT CAN BE IRRADIATED IN THE REACTOR CORE PER CYCLE (TAC NO. MD9396)

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for Technical Specifications (TS) change, WBN-TS-08-04, to License NPF-90 for WBN Unit 1. The proposed TS changes will revise TS 4.2.1, “Fuel Assemblies,” and Technical Specification Surveillance Requirements 3.5.1.4, "Accumulators," and 3.5.4.3, "RWST," to increase the maximum number of Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated per cycle from 400 to 704. This change is analogous to the change implemented in Amendment 67, which increased the maximum number of TPBARs that can be irradiated from 240 to 400, and has been evaluated using the methodology employed for Amendment 67. Specifically, a representative core design with 704 TPBARs was developed. A post-LOCA long term cooling subcriticality evaluation was performed for this core design using the same methodology employed in Amendment 67. This analysis demonstrated post-LOCA subcriticality using the current ECCS minimum boron concentrations. No credit for control rod insertion was assumed.

This submittal supersedes in its entirety the license amendment request (LAR) submitted to the staff on August 1, 2008 (ref. 1). TVA has opted to simplify the original LAR and is, therefore, removing the following changes from the application:

1. increase the maximum allowable inventory of TPBARs from 400 to 2304,

2. credit control rod insertion in the post-LOCA subcriticality assessment for cold leg break LOCAs,

3. increase the maximum ECCS boron concentration specification for the RWST and accumulator from 3300 ppm to 3800 ppm, and

4 implement three discrete levels of boron concentrations corresponding to three different minimum boron concentrations for the RWST and cold leg

accumulators. The specific level required for the reload core to ensure post-LOCA subcriticality would be specified in the Core Operating Limits Report (COLR).

With this simplification of the LAR, the only change that will be requested is an increase in the maximum TPBAR inventory from 400 TPBARs (current value) to 704 TPBARs. Consequently, the revised LAR is analogous to the LAR approved in Amendment 67 on January 18, 2008 (ref. 2). That amendment increased the maximum TPBAR inventory from 240 to 400 TPBARs.

As you know, the U.S. Department of Energy (DOE) and TVA entered into an Interagency Agreement to allow TVA to produce tritium for the National Security Stockpile by irradiating TPBARs at WBN. In order to meet DOE's tritium production requirements, and in furtherance of the nation's defense needs, the proposed change is needed by the Cycle 9 refueling outage in order to increase TPBAR inventories in future Watts Bar Unit 1 core designs. Accordingly, in order to help ensure an adequate supply of tritium for national defense purposes, we request that this LAR be given a high priority.

Enclosure 1 to this letter provides the description and technical evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Annotated versions of the affected TS pages are provided in Enclosure 2. Annotated versions of the affected TS Bases pages are given in Enclosure 3, for information only.

Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and attachments to the Tennessee State Department of Public Health.

For the national security-related reasons explained above, TVA requests approval of this TS change by August 2009 to support WBN Cycle 9 refueling outage and that implementation of the revised TS be prior to entry to MODE 3 for Cycle 10.

There are no regulatory commitments associated with this submittal.

If you have any questions about this change, please contact R. L. Clark at (423) 365-1818 or me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 31st day of December, 2008.

Sincerely,

Original signed by

C. J. Riedl (acting for M. K. Brandon
Manager, Site Licensing and
Industry Affairs)

Enclosures:

1. TVA Evaluation Of Proposed Technical Specifications Change
2. Proposed Technical Specifications Change (Mark-Up)
3. Proposed Technical Specifications Bases Change (Mark-Up)

cc: See page 4

MKB:RCC
Enclosures
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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY (TVA)
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

TVA EVALUATION OF PROPOSED TECHNICAL SPECIFICATIONS CHANGE

TECHNICAL EVALUATION

1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for Technical Specifications (TS) change, WBN-TS-08-04, to License NPF-90 for WBN Unit 1. The proposed TS changes will revise TS 4.2.1, “Fuel Assemblies,” and Technical Specification Surveillance Requirements 3.5.1.4, "Accumulators," and 3.5.4.3, "RWST," to increase the maximum number of Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated per cycle from 400 to 704. This change is analogous to the change implemented in Amendment 67, which increased the maximum number of TPBARs that can be irradiated from 240 to 400, and has been evaluated using the methodology employed for Amendment 67. Specifically, a representative core design with 704 TPBARs was developed. A post-LOCA long term cooling subcriticality evaluation was performed for this core design using the same methodology employed in Amendment 67. This analysis demonstrated post-LOCA subcriticality using the current ECCS minimum boron concentrations. No credit for control rod insertion was assumed.

This submittal supersedes in its entirety the license amendment request (LAR) submitted to the staff on August 1, 2008 (ref. 1). TVA had requested that the original LAR implement the following changes:

1. increase the maximum allowable inventory of TPBARs from 400 to 2304,
2. credit control rods in the post-LOCA subcriticality assessment for cold leg break LOCAs,
3. increase the maximum ECCS boron concentration specification for the RWST and accumulator from 3300 ppm to 3800 ppm, and
4. implement technical specification changes to the RWST and accumulator minimum boron concentration specifications.

The RWST and accumulator technical specification changes would define three discrete levels of boron concentrations corresponding to three different minimum boron concentrations for the RWST and cold leg accumulators. The specific level required for the reload core to ensure post-LOCA subcriticality would be specified in the Core Operating Limits Report (COLR).

TVA has opted to simplify the LAR. The only change that will be requested is an increase in the maximum TPBAR inventory from 400 TPBARs (current value) to 704 TPBARs. Consequently, the revised LAR is analogous to the LAR approved in Amendment 67 on January 18, 2008 (ref. 2). That amendment increased the maximum TPBAR inventory from 240 to 400 TPBARs.

The proposed changes will allow additional flexibility to increase TPBAR inventories in future Watts Bar Unit 1 core designs to support national security needs.

2.0 DETAILED DESCRIPTION

This amendment request will revise TS 4.2.1, “Fuel Assemblies,” and Technical Specification Surveillance Requirements 3.5.1.4, "Accumulators," and 3.5.4.3, "RWST," to increase the maximum number of Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated per cycle from 400 to 704. Although the maximum TPBAR limit requested is 704, the number of TPBARs to be irradiated in WBN Cycle-10 is planned to be approximately 576. The analysis to support the irradiation of 704 TPBARs is provided with this amendment request. The appropriate changes to the bases are provided in Enclosure 3 for information only. The proposed changes have been applied to the issued pages previously approved by NRC on January 18, 2008, in WBN Amendment 67. In summary, TVA plans to irradiate approximately 576 TPBARs in Cycle 10. Approval of this amendment request will authorize the irradiation of up to (and including) 704 TPBARs.

3.0 TECHNICAL EVALUATION

3.1 <u>Background</u>

Department of Energy (DOE) and Tennessee Valley Authority (TVA) have agreed to cooperate in a program to produce tritium for the National Security Stockpile by irradiating Tritium Producing Burnable Absorber Rods (TPBARs) at Watts Bar Nuclear Plant (WBN).

TPBARs are similar to standard burnable poison rod assemblies (BPRAs) inserted into fuel assemblies. The BPRAs absorb excess neutrons, and help control the power in the reactor to ensure an even power distribution and extend the time between refueling outages. TPBARs functions in a matter similar to a BPRA, but TPBARs absorb neutrons using lithium aluminate instead of boron. Tritium is produced when the neutrons strike the lithium material. A solid zirconium material in the TPBAR (called a “getter”) captures the tritium as it is produced. Most of the tritium is trapped in the getter material. However, a small fraction of the tritium will permeate through the TPBAR cladding into the reactor coolant system (see Section 3.2.2). After the TPBARs are removed from the core, and shipped to DOE extraction facility, the TPBARs are heated in a vacuum at high temperature to extract the tritium.

The environmental impacts of producing tritium at WBN were assessed in a Final Environmental Impact Statement (EIS) for the Production of Tritium in a Commercial Light Water Reactor (DOE/EIS - 0288, March 1999) prepared by DOE. TVA was a cooperating agency in the preparation of this EIS, and adopted the EIS in accordance with 40 CFR 1506.30 of the Council on Environmental Quality regulations. TVA’s *Record of Decision* (ROD*) and Adoption of the Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* was published in the Federal Register at 65 Fed. Reg. 26259 (May 5, 2000). In addition to the DOE EIS and TVA’s ROD, a Tritium Production Core (TPC) Topical Report (NDP-98-181, Rev. 1) was prepared by DOE to address the safety and licensing issues associated with incorporating TPBARs in a PWR. The Nuclear Regulatory Commission’s (NRC) Standard Review Plan (SRP) (NUREG-0800) was used as the basis for evaluating the impact of the TPBARs on a reference plant. The NRC reviewed the TPC Topical Report and issued a Safety Evaluation Report (SER) (NUREG-1672) to support plant-specific licensing of TPBARs in a PWR.

The first TPBARs irradiated in WBN were in 4 lead test assemblies (LTAs), containing a total of 32 TPBARs during WBN Cycle 2. NRC approval of the LTAs was documented in WBN operating license Amendment 8 (ref. 3).

Amendment 40 (ref. 4) to the WBN operating license approved the irradiation of up to 2,304 TPBARs in WBN. The exact number of TPBARs to be irradiated would be identified in the safety evaluation performed by Westinghouse for each reload core and noted in the Core Operating Limits Report (COLR).

Based on issues related to the Reactor Coolant System (RCS) boron concentration, the TVA letter of August 18, 2003 revised the license amendment request dated May 30, 2003 and limited the number of TPBARs to be irradiated to 240 in WBN Cycle 6. This was approved with the issuance of Amendment 48 (ref. 5) to the WBN operating license. Based on issues related to tritium permeation observed in Cycle 6, TVA limited the number of TPBARs to be irradiated to 240 in Cycles 7 and 8. Design changes made to the TPBARs scheduled for Cycle 9 (current cycle) resulted in a request to increase the number of TPBARs to be irradiated to 400. This request was approved with the issuance of WBN operating license Amendment 67 (ref. 2). The actual number of TPBARs being irradiated in Cycle 9 is 368.

As described in this license amendment request, TVA is now requesting approval to revise the number of TPBARs that can be irradiated in any operating cycle to 704. The number of TPBARs to be irradiated in any given operating cycle will be evaluated in the reload safety evaluation and documented in the COLR. The number will not exceed 704.

The following is a general discussion of how core parameters including TPBARs affect soluble boron worth and its effect on post-LOCA subcriticality margin. The general design requirements for the cold leg accumulators (CLAs) and RWST are also provided.

The soluble boron in the CLAs and RWST provides negative reactivity to maintain subcriticality following a LOCA. For a given core design, the boron concentration required to achieve subcriticality is a function of several variables, including global core reactivity and boron worth. The global core reactivity is determined by the cycle energy and the detailed core design. For example, the combination of a larger cycle energy and a smaller burnable absorber inventory would lead to a larger global core reactivity and, therefore, higher CLA and RWST minimum boron concentrations to ensure subcriticality.

The boron worth is dependent upon the total neutron absorption in the core, which is also determined by the detailed core design. When large amounts of neutron absorbers are used in the core design (as in the case with large numbers of TPBARs), there is competition for thermal neutrons among all the absorbers which result in hardening of the thermal neutron spectrum (shift towards higher neutron energy). As a consequence, the negative worth of each absorber, including reactor coolant system (RCS) boron worth, decreases. The positive reactivity insertion due to the cooldown from hot full power to cold conditions following a LOCA must be overcome by RCS boron and burnable absorbers to maintain subcriticality.

The minimum boron requirement for the CLA ensures that the reactor core will remain subcritical during the post-LOCA recirculation phase based upon the CLA's contribution to the post-LOCA sump mixture concentration. The functions and design of the CLAs are found in Section 6.3 of the WBN Updated Final Safety Analysis Report (UFSAR). The minimum boron requirement for the RWST ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by reactor coolant system cooldown. The RWST serves several purposes in addition to the injection of borated water during accident conditions. These functions are described in various sections of the UFSAR, including Sections 6.2, Containment Systems, 6.3, Emergency Core Cooling System, 9.1.3, Spent Fuel Pool Cooling and Cleanup System, 15.2.4, Uncontrolled Boron Dilution, and 15.4.3, Steam Generator Tube Rupture.

The CLAs are required to be operable in Modes 1, 2 and 3 and the RWST in Modes 1, 2, 3, and 4. WBN Surveillance Requirements 3.5.1.4 and 3.5.4.3 associated with these functions also include requirements for borated water volume. The CLA specification has isolation valves and nitrogen cover-pressure requirements and the RWST specification includes requirements for temperature. These limitations support the ability of the CLAs and RWST to replace water to keep the core cooled and to ensure that sufficient boron is available to maintain the reactor in a subcritical condition during postulated accident conditions. The CLAs are passive devices that inject automatically when the reactor coolant system pressure drops below the accumulator's cover-pressure. The RWST provides borated water to the emergency core cooling system pumps for injection into the reactor. Three different sets of pumps are utilized to accommodate different size breaks in the reactor coolant system. The RWST also provides water to the containment spray system to control containment pressure during high energy line break accidents. When the injection of the RWST volume has been completed, the pumps switchover to the containment sump to continue the core cooling and containment pressure control functions.

3.2 Technical Analyses

Section 3.2.1 evaluates post-LOCA subcriticality for a representative core design with 704 TPBARs using the current RWST and CLA boron concentrations. This analysis considers the whole range of break sizes up to and including a double ended guillotine rupture of the main coolant loop piping.

Section 3.2.2 evaluates the projected tritium release rate from irradiated TPBARs which will be used to establish the number of TPBARs that can be irradiated in a given cycle to assure that the annual limit of 2,304 Ci is not exceeded. The projected tritium release rate is based on data obtained from Cycles 6, 7, and 8.

3.2.1 Post-LOCA Subcriticality Evaluation

Amendment 67 increased the maximum TPBAR inventory from 240 to 400 TPBARs. The LAR supporting Amendment 67 included a post-LOCA subcriticality evaluation for a representative core design with 400 TPBARs to demonstrate subcriticality assuming the current RWST and cold leg accumulator minimum boron concentrations (3100 ppm and 3000 ppm, respectively).

In a similar fashion, to support the increase in the maximum TPBAR inventory to 704 TPBARs, a representative core design has been developed that employs 704 TPBARS. Post-LOCA long term cooling subcriticality analyses were performed for this core design using the same codes and methods used in the Amendment 67 analysis and using the same RWST and cold leg accumulator minimum boron concentrations. Control rod insertion was not credited, consistent with current methodology.

The 704 TPBAR core design is a hypothetical Cycle 10 core design that is representative of current and future Watts Bar Unit 1 core designs. It generates a cycle energy of 484 EFPD using a total of 85 feed assemblies and incorporating 9644 integral fuel burnable absorber (IFBA) rods and 704 TPBARs. Post-LOCA subcriticality evaluations were performed for the same scenarios as described in Amendment 67. Specifically, the post-LOCA long term cooling subcriticality evaluation considers two scenarios: (1) the hot leg break scenario and (2) the cold leg break scenario.

In the hot leg break scenario, TPBAR failure is not expected due to the low temperatures of the fuel and TPBARs. Therefore, the assumptions for evaluating this scenario are as follows:

a) no TPBAR failures,

b) no xenon in the cold critical boron calculation,

c) no control rod insertion,

d) cold conditions (50 ºF to 212 ºF),

e) a pre-condition of peak xenon to minimize the RCS boron concentration, and

f) most reactive time in life.

Because the TPBARs remain intact, the hot leg break scenario is less limiting than the cold leg break scenario. In the cold leg break scenario, TPBAR failure is conservatively assumed to occur. The key assumptions for this scenario are:

a) a pre-condition of peak xenon to minimize the RCS boron concentration,

b) cold conditions (50 ºF to 212 ºF),

c) TPBAR failure for interior TPBARs with 50% Li-6 leaching and loss of 12 inches of $LiAlO_2$ pellets,

d) no control rod insertion,

e) sump dilution at the time of hot leg switchover (HLSO),

f) a conservative xenon credit at the time of hot leg switchover (3 hours), and

g) most reactive time in life.

This scenario differs from the hot leg break scenario due to the assumption of TPBAR failure and the potential for sump dilution. At HLSO, the TPBAR failure assumptions are very conservative since leaching of the TPBARs is not instantaneous. The expected leaching rate is 3% per day; therefore, less than 0.5% of the lithium would have leached at the time of HLSO (3 hours), which is negligible. For the cold leg break, the limiting time is at hot leg switchover when the diluted sump water is conservatively assumed to displace the highly borated water in the reactor vessel without mixing. A long term subcriticality assessment with no xenon is also performed for cold leg break scenario, but it is never limiting due to the conservative assumptions employed in the HLSO assessment.

In the evaluation of the 704 TPBAR core design, cycle burnups up to 10000 MWD/MTU were considered. Post-LOCA subcriticality margin is limiting early in the cycle, so that cycle burnups beyond 10000 MWD/MTU are clearly non-limiting.

The sump boron concentration used in the evaluation is calculated in a bounding fashion for several different times after event initiation and assumes the minimum RWST, accumulator, and containment ice boron concentrations permitted by the plant Technical Specifications. Also, the fluid masses assumed in the calculation are chosen in a conservative fashion, e.g., minimum RWST and accumulator fluid masses are assumed and a maximum reactor coolant system (RCS) fluid mass is assumed (since the RCS, due to its relatively low boron concentration, represents a dilution source). Since the RCS boron concentration varies with cycle burnup, the sump boron concentration is a function of RCS boron concentration. In the post-LOCA subcriticality methodology, the RCS boron employed is the hot full power (HFP) critical boron concentration assuming peak xenon at the burnup of interest. The conservative assumption of peak xenon has the effect of minimizing the RCS concentration which, in turn, conservatively reduces the sump boron concentration.

The sump boron concentration curves are maintained as key safety parameters in the reload safety evaluation process. Three sump boron curves are generated corresponding to three different times following the break: (1) at initiation of cold leg recirculation, (2) at hot leg switchover, and (3) at 16 hours following the break. These sump boron curves account for a hypothetical unborated dilution source that would enter the containment at a maximum rate of 40 gpm and would be isolated within 16 hours after the break. Subcriticality evaluations are performed at hot leg switchover and at 16 hours after the break. The subcriticality evaluation at initiation of cold leg recirculation is non-limiting because the available sump boron concentration at that time is larger than the sump boron concentration assumed at HLSO.

The current Watts Bar Unit 1 ECCS minimum boron concentrations are given in Table 1 below. As discussed above, the RCS boron concentration is minimized through the assumption of peak xenon as the accident pre-condition. ANC is used to calculate the HFP, peak xenon critical boron concentration at the most reactive time in life. The sump boron, which is specified as a function of the RCS boron, can then be determined using the sump boron curves.

Table 1
Current RWST and Accumulator Boron Concentrations

Accumulator Minimum Boron Concentration (ppm)	**Accumulator Maximum Boron Concentration (ppm)**	**RWST Minimum Boron Concentration (ppm)**	**RWST Maximum Boron Concentration (ppm)**
3000	3300	3100	3300

To determine the subcriticality margin, critical boron concentrations are calculated at post-LOCA conditions using ANC and assuming no xenon. The coolant conditions are atmospheric pressure and the most reactive temperature between 50 °F and 212 °F (typically higher coolant temperatures are very slightly more limiting). For the HLSO subcriticality assessment, a conservative xenon credit is taken since HLSO occurs 3 hours into the transient, at which time a significant xenon inventory would be present in the core. For a HLSO time of 3 hours, the xenon credit assumed is 210 ppm.

The subcriticality margin is calculated by subtracting the calculated critical boron concentration from the available sump boron concentration. Tables 2, 3, and 4 give the subcriticality assessments for the hot leg break scenario, the cold leg break long term assessment, and the cold leg break assessment at HLSO for the core design with 704 TPBARs. These assessments employ the same key assumptions as in Amendment 67. The results in Table 5 give the subcriticality margin for the HLSO assessment but without TPBAR failure. Comparison of the Table 4 and 5 results provides an estimate of the margin loss due to TPBAR failure.

Table 2 Post-LOCA Subcriticality Margin for a Hot Leg Break for 704 TPBAR Core				
Burnup (MWD/MTU)	**Pre-condition Boron Concentration HFP, Peak Xenon (ppm)**	**Sump Boron (ppm)**	**No Xenon, Cold Critical Boron (ppm)**	**Subcriticality Margin (ppm)**
150	860	2048	1800	248
1000	881	2051	1816	235
2000	924	2057	1845	212
3000	944	2060	1860	200
4000	937	2059	1860	199
6000	871	2050	1827	223
8000	756	2035	1761	274
10000	613	2016	1672	344

Table 3 Post-LOCA Subcriticality for a Cold Leg Break: Long Term Assessment for 704 TPBAR Core				
Burnup (MWD/MTU)	**Pre-condition Boron Concentration HFP, Peak Xenon (ppm)**	**Sump Boron (ppm)**	**No Xenon, Cold Critical Boron (ppm)**	**Subcriticality Margin (ppm)**
150	860	2048	1878	170
1000	881	2051	1896	155
2000	924	2057	1928	129
3000	944	2060	1946	114
4000	937	2059	1949	110
6000	871	2050	1921	129
8000	756	2035	1858	177
10000	613	2016	1770	246

Table 4 Post-LOCA Subcriticality for a Cold Leg Break: HLSO Assessment for 704 TPBAR Core						
Burnup (MWD/MTU)	**Pre-condition Boron Conc. HFP, Peak Xenon (ppm)**	**Sump Boron (ppm)**	**No Xenon, Cold Critical Boron (ppm)**	**Xenon Credit (ppm)**	**Cold Critical Boron with Xenon Credit (ppm)**	**Subcriticality Margin (ppm)**
150	860	1756	1878	210	1668	88
1000	881	1760	1896	210	1686	74
2000	924	1769	1928	210	1718	51
3000	944	1773	1946	210	1736	37
4000	937	1772	1949	210	1739	33
6000	871	1758	1921	210	1711	47
8000	756	1734	1858	210	1648	86
10000	613	1704	1770	210	1560	144

Table 5 Post-LOCA Subcriticality for a Cold Leg Break: HLSO Assessment Assuming No TPBAR Failure for 704 TPBAR Core						
Burnup (MWD/MTU)	**Pre-condition Boron Conc. HFP, Peak Xenon (ppm)**	**Sump Boron (ppm)**	**No Xenon, Cold Critical Boron (ppm)**	**Xenon Credit (ppm)**	**Cold Critical Boron with Xenon Credit (ppm)**	**Subcriticality Margin (ppm)**
150	860	1756	1800	210	1590	166
1000	881	1760	1816	210	1606	154
2000	924	1769	1845	210	1635	134
3000	943	1773	1860	210	1650	123
4000	937	1772	1860	210	1650	122
6000	870	1758	1827	210	1617	141
8000	756	1734	1761	210	1551	183
10000	613	1704	1672	210	1462	242

As the tables show, 4000 MWD/MTU is the most limiting time in life for each scenario. Also, as expected, the HLSO assessment is the most limiting scenario with a minimum margin of 33 ppm for this core design. HLSO is limiting due to the conservative assumptions of TPBAR failure and sump dilution with no mixing in the vessel.

The subcriticality margin values in Tables 4 and 5 show that, at 4000 MWD/MTU, the worth of the Li-6 lost due to TPBAR failure is 89 ppm (122 ppm – 33 ppm). This is equivalent to 0.13 ppm per TPBAR, which is consistent with the sensitivity values determined in Amendment 67.

In addition to the above scenarios, subcriticality during reflood was examined for this core model. In the reflood evaluation, the vessel reflood boron concentration is dependent on the boron concentration of the RCS fluid remaining in the vessel following blowdown and the cold leg accumulator boron concentration. For the 704 TPBAR core, the minimum accumulator boron concentration of 3000 ppm results in a substantial subcriticality margin of 563 ppm. This margin assessment credits full power equilibrium xenon. In this evaluation, the presence of xenon can be credited since reflood occurs within minutes of event initiation; therefore, essentially no xenon decay will have occurred. Control rod insertion is not credited. For cold leg breaks, this reflood evaluation is sufficient to confirm subcriticality from the time of reflood until hot leg switchover since the reactor vessel boron increases during this time due to boiling in the core. For hot leg breaks, the long term subcriticality assessment is more limiting than the reflood assessment since no xenon is assumed in the long term evaluation and the sump boron decreases with time (until 16 hours) following completion of reflood.

In summary, these results confirm that adequate subcriticality margin can be demonstrated for a representative core design with 704 TPBARs using the current ECCS minimum boron concentrations and current methodology. In the event that subcriticality for a core design under consideration cannot be demonstrated using the current methodology, then either the core design will be modified or a new license amendment request will be initiated. Post-LOCA subcriticality will continue to be evaluated for each core design as part of the cycle specific comprehensive reload safety evaluation process.

3.2.2 TPBAR Tritium Release Rate

Design changes to reduce TPBAR tritium permeation was submitted to the NRC, as Technical Specification Change 07-01 and was approved by the NRC in Amendment No. 67. The modified TPBARs were installed in the reactor core during Cycle 9 that began March 2008. Technical Specification Change 07-01 confirmed that TVA would continue to apply the TPBAR performance metric of 2,304 Ci/year for tritium permeation into the RCS as established in WBN License Amendment No. 40. As noted below, the releases from Cycle 6, Cycle 7, and Cycle 8 on a calendar year basis were well below this limit.

Calculations indicated that the actual Cycle 6 TPBAR tritium release was 576 ± 240 Ci/year. Taking the upper bound on the uncertainty, the TPBAR tritium release was 816 Ci/year. The actual tritium release from Cycle 7 TPBARs was calculated to be 648 ± 240 Ci/year or an upper bound of 888 Ci/year. The actual tritium release from Cycle 8 TPBARs was calculated to be 696 ± 240 Ci/year or an upper bound of 936 Ci/year. The difference in the results is within the statistical uncertainty associated with the measurements. With these releases and 240 TPBARs in each cycle, the tritium release on a calendar year basis for Cycle 6, Cycle 7, and Cycle 8 continued to be well below regulatory limits and the limit of 2,304 Ci/year attributable to TPBARs. The tritium permeation from TPBARs in Cycle 8 closely tracked that of Cycle 7 (Figure 1).

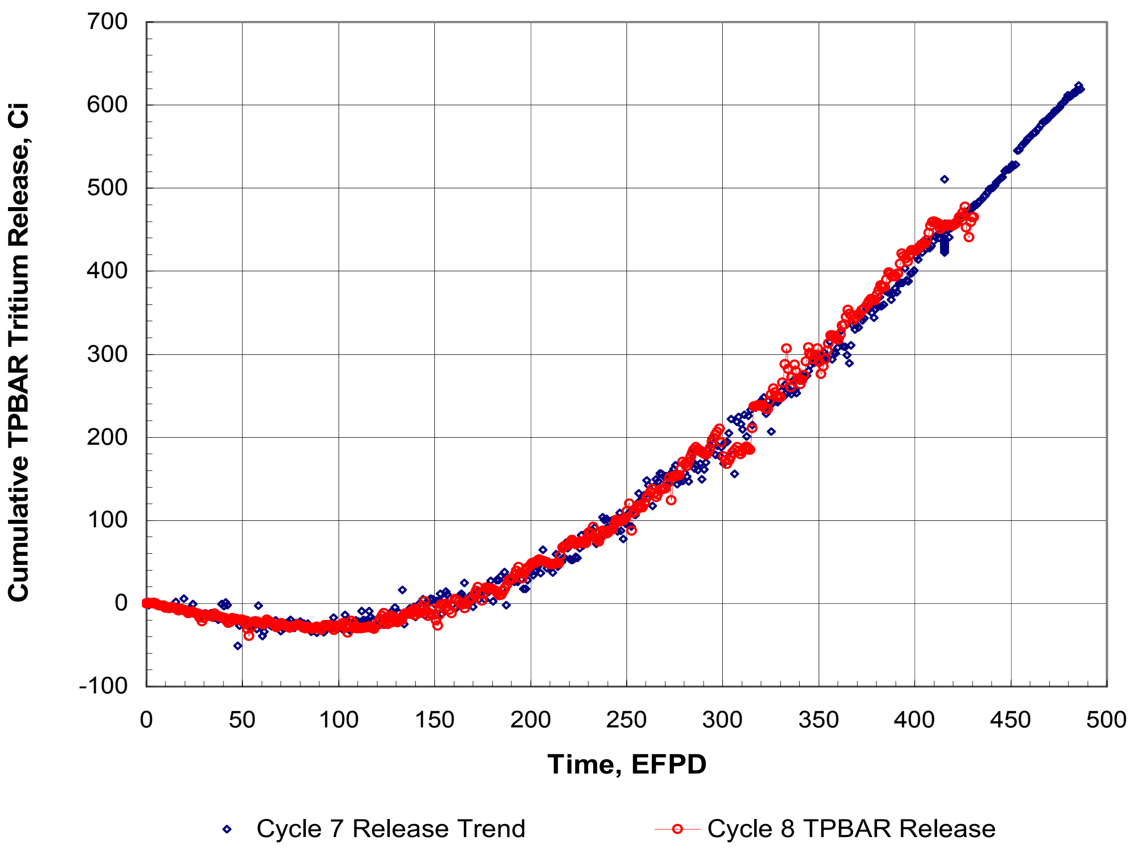

Figure 1

Cumulative TPBAR Tritium Release to RCS in Cycles 7 and 8 as a function of time in effective Full Power Days

TPBAR performance over the past three cycles (Cycle 6, Cycle 7, and Cycle 8) has demonstrated that increasing the number of TPBARs in the core can be accommodated without exceeding the tritium limit of 2,304 Ci/year attributable to TPBARs. These increases can be accomplished even if the design changes addressed in Technical Specification Change 07-01 are not effective and the tritium permeation from future Cycle TPBARs is at the same level as from Cycles 6, 7, and 8. The effectiveness of the changes will be determined through the monitoring of RCS tritium levels throughout future fuel cycle operation. The proposed amendment will increase the limit on the number of TPBARs that can be irradiated in the WBN core from 400 to 704, which is bounded by the analyses supporting the 2,304 limit imposed with Amendment Number 40.

As a normal part of the reload safety evaluation process TVA will calculate the expected tritium release from the TPBARs to establish the number of TPBARs to be irradiated in a given cycle to assure that the annual limit of 2,304 Ci/yr is not exceeded.

4.0 REGULATORY EVALUATION

4.1 No Significant Hazards Consideration

The proposed TS change will revise Watts Bar Nuclear Plant (WBN) Unit 1 Technical Specification (TS) Surveillance Requirements (SRs) 3.5.1.4, "Accumulators," 3.5.4.3, "Refueling Water Storage Tank (RWST)," and 4.2.1, "Fuel Assemblies" to modify the maximum number of tritium producing burnable absorber rods (TPBARs) in the core. This proposed change will allow the flexibility to increase the number of TPBARs in the core. Whether or not a significant hazards consideration is involved with the proposed amendment was determined by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

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

   Response: No.

   The proposed change modifies the maximum number of TPBARs in the core. The required boron concentration for the cold leg accumulators (CLAs) and RWST remains unchanged. The current boron concentration has been demonstrated to maintain the required accident mitigation safety function for the CLAs and RWST with-the higher number of TPBARs and this will be verified for each core that contains TPBARs as part of the normal reload analysis. The CLAs and RWST safety function is to mitigate accidents that require the injection of borated water to cool the core and to control reactivity. These functions are not potential sources for accident generation and the modification of the number of TPBARs will not increase the potential for an accident. Therefore, the possibility of an accident is not increased by the proposed changes. The current boron concentration levels are supported by the proposed number of TPBARs in the core. Since the current boron concentration levels will continue to maintain the safety function of the CLAs and RWST in the same manner as currently approved, the consequences of an accident are not increased by the proposed changes.

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

   Response: No

   The proposed change only modifies the maximum number of TPBARs in the core. The boron concentrations for accident mitigation functions of the CLAs and RWST remain unchanged. These functions do not have a potential to generate accidents as they only serve to perform mitigation functions associated with an accident. The proposed modification will maintain the mitigation function in an identical manner as currently approved. There are no plant equipment or operational changes associated with the proposed revision. Therefore, since the CLA and RWST functions are not altered and the plant will continue to operate without change, the possibility of a new or different kind of an accident is not created.

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

   Response: No.

   This change proposes a change to the maximum number of TPBARs in the core. The boron concentration requirements that support the accident mitigation functions of the CLAs and RWST remain unchanged. The proposed change does not alter-any plant equipment or components and does not alter any setpoints utilized for the actuation of accident mitigation system or control functions. The proposed number of TPBARs, in conjunction with the current boron concentration values, has been demonstrated to provide an adequate level of reactivity control for accident mitigation and this will be verified for each core that contains TPBARs as part of the normal reload analysis. Therefore, the proposed change will not involve a significant reduction in a margin of safety.

4.2 Applicable Regulatory Requirements/Criteria

The CLA and RWST functions are described in the Updated Final Safety Analysis Report (UFSAR) Sections 6.2.2, 6.3, 9.1, 15.2.4 and 15.4.3, respectively. For these sections, the principal review performed by NRC is documented in the Safety Evaluation Report (SER), NUREG-0847, dated June 1982. The assessment of these functions is documented in the following sections of the SER:

Section 6.2.2	Containment Heat Removal Systems
Section 6.3	Emergency Core Cooling System
Section 9.1	Fuel Storage Facility
Section 15.2.4	Reactivity and Power Distribution Anomalies
Section 15.4	Radiological Consequences of Accidents

Subsequent to the above review, by application dated August 20, 2001, TVA requested a license amendment to revise the WBN TS to address the irradiation of TPBARs for the DOE. Part of that amendment requested that both the CLA and RWST boron concentrations be raised to accommodate the irradiation of a maximum of 2,304 TPBARs during a single cycle . NRC approved and issued a Safety Evaluation (SE) for amendment 40 on September 23, 2002. NRC's review of those boron concentration changes is documented in SE Section 3.2, "Evaluation of Technical Specification Changes."

Based on issues related to the Reactor Coolant System (RCS) boron concentration, the TVA letter of August 18, 2003 revised the license amendment request dated May 30, 2003 and limited the number of TPBARs to be irradiated to 240 in WBN Cycle 6. This was approved with the issuance of Amendment 48 (ref. 5) to the WBN operating license. Based on issues related to tritium permeation observed in Cycle 6, TVA limited the number of TPBARs to be irradiated to 240 in cycles 7 and 8. Design changes made to the TPBARs scheduled for Cycle 9 (current cycle) resulted in a request to increase the number of TPBARs to be irradiated to 400. This request was approved with the issuance of WBN operating license Amendment 67 (ref. 2). The actual number of TPBARs being irradiated in Cycle 9 is 368. Amendment 67 demonstrated that the current ECCS boron concentrations are adequate to ensure post-LOCA subcriticality for a core with up to 400 TPBARs.

The proposed amendment, which is identical in scope to amendment 67, will increase the limit on the number of TPBARs that can be irradiated in the WBN core to 704. The current CLA and RWST boron concentration requirements in SRs 3.5.1.4, "Accumulators," and 3.5.4.3, "Refueling Water Storage Tank (RWST)," for 400 TPBARs also provides adequate protection for 704 TPBARs. Analyses in the amendment show that the existing boron concentrations for 400 TPBARs will prevent a recriticality event for a core with 704 TPBARs during postulated accidents and will not adversely affect compliance with the requirements for emergency core cooling systems in 10 CFR 50.46 or Appendix K of 10 CFR50. The ability of the current CLA and RWST boron concentration requirements to ensure subcriticality during postulated accidents will continue to be assessed each cycle as part of the reload safety evaluation process.

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

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, based on the Environmental Impact Statement (EIS) prepared by the DOE (ref. 6), 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. TVA's letter to NRC dated August 1, 2008, "Watts Bar Nuclear Plant (WBN), Unit 1 – Technical Specifications Change – "Revision of Boron Requirements for Cold Leg Accumulators and Refueling Water Storage Tank.""

2. NRC letter to TVA dated January 18, 2008, "Watts Bar Nuclear Plant, Unit 1 –Issuance of Amendment Regarding the Maximum Number of Tritium Producing Burnable Assembly Rods in the Reactor Core (TAC NO. MD5430)."

3. NRC letter to TVA dated September 15, 1997, "Issuance of Amendment on Tritium Producing Burnable Absorber Lead Test Assemblies (TAC NO. M98615)."

4. NRC letter to TVA dated September 23, 2002, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment to Irradiate Up to 2304 Tritium-Producing Burnable Absorber Rods in the Reactor Core (TAC NO. MB1884)."

5. NRC letter to TVA dated October 8, 2003, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Revision of Boron Requirements for Cold Leg Accumulators and Refueling Water Storage Tank (TAC NO. MB9480)."

6. TVA's letter to NRC dated May 23, 2002, "Watts Bar Nuclear Plant – Request for Additional Information (RAI) Regarding Radiological Impact (TAC NO. MB1884)."

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

PROPOSED TECHNICAL SPECIFICATIONS CHANGE (MARK-UP)

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1. AFFECTED TS PAGES

   TS 3.5-2
   TS 3.5-10
   TS 4.0-1

2. see attached

   Note: The deletions are shown as strikethrough text and the additions are shown as bold italicized text.

SURVEILLANCE REQUIREMENTS

<table>
<tr><th colspan="2">SURVEILLANCE</th><th>FREQUENCY</th></tr>
<tr><td>SR 3.5.1.1</td><td>Verify each accumulator isolation valve is fully open.</td><td>12 hours</td></tr>
<tr><td>SR 3.5.1.2</td><td>Verify borated water volume in each accumulator is ≥ 7630 gallons and ≤ 8000 gallons.</td><td>12 hours</td></tr>
<tr><td>SR 3.5.1.3</td><td>Verify nitrogen cover pressure in each accumulator is ≥ 610 psig and ≤ 660 psig</td><td>12 hours</td></tr>
<tr><td>SR 3.5.1.4</td><td>-------------------------------NOTE--------------------------------
The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle.

Verify boron concentration in each accumulator is as provided below depending on the number of tritium producing burnable absorber rods (TPBARs) installed in the reactor core for this operating cycle:
<table><tr><th>Number of TPBARS</th><th>Boron Concentration Ranges</th></tr><tr><td>0-~~400~~ ***704***</td><td>≥ 3000 ppm and ≤ 3300 ppm</td></tr></table></td><td>31 days

<u>AND</u>

-------NOTE -----------
Only required to be performed for affected accumulators.

Once within 6 hours after each solution volume increase of ≥ 75 gallons, that is not the result of addition from the refueling water storage tank.</td></tr>
</table>

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	------------------------------NOTE--------------------------------- Only required to be performed when ambient air temperature is < 60°F or > 105°F. --- Verify RWST borated water temperature is ≥ 60°F and ≤ 105°F.	24 hours
SR 3.5.4.2	Verify RWST borated water volume is ≥ 370,000 gallons.	7 days
SR 3.5.4.3	---------------------------------NOTE--------------------------------- The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle. --- Verify boron concentration in the RWST is as provided below depending on the number of tritium producing burnable absorber rods (TPBARs) installed in the reactor core for this operating cycle:	7 days

Number of TPBARS	Boron Concentration Ranges
0-~~400~~ ***704***	≥ 3100 ppm and ≤ 3300 ppm

4.0 DESIGN FEATURES

4.1 Site

4.1.1 Site and Exclusion Area Boundaries

The site and exclusion area boundaries shall be as shown in Figure 4.1-1.

4.1.2 Low Population Zone (LPZ)

The LPZ shall be as shown in Figure 4.1-2 (within the 3-mile circle).

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of Zircalloy or Zirlo fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions. For Unit 1, Watts Bar is authorized to place a maximum of ~~400~~ ***704*** Tritium Producing Burnable Absorber Rods into the reactor in an operating cycle.

4.2.2 Control Rod Assemblies

The reactor core shall contain 57 control rod assemblies. The control material shall be boron carbide with silver indium cadmium tips as approved by the NRC.

(continue)

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

PROPOSED TECHNICAL SPECIFICATIONS BASES CHANGE (MARK-UP)
(FOR INFORMATION ONLY)

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1. AFFECTED TS BASES PAGES

   TS B3.5-26

2. see attached

   Note: The deletions are shown as strikethrough text and the additions are shown as bold italicized text.

APPLICABLE SAFETY ANALYSES (continued)

volume. The deliverable volume limit is set by the LOCA and containment analyses. For the RWST, the deliverable volume is different from the total volume contained since, due to the design of the tank, more water can be contained than can be delivered. The minimum boron concentration is an explicit assumption in the main steam line break (MSLB) analysis to ensure the required shutdown capability. The maximum boron concentration is an explicit assumption in the inadvertent ECCS actuation analysis, although it is typically a nonlimiting event and the results are very insensitive to boron concentrations. The maximum temperature ensures that the amount of cooling provided from the RWST during the heatup phase of a feedline break is consistent with safety analysis assumptions; the minimum is an assumption in both the MSLB and inadvertent ECCS actuation analyses, although the inadvertent ECCS actuation event is typically nonlimiting.

The MSLB analysis has considered a delay associated with the interlock between the VCT and RWST isolation valves, and the results show that the departure from nucleate boiling design basis is met. The delay has been established as 27 seconds, with offsite power available, or 37 seconds without offsite power.

Technical Specification Surveillance Requirements 3.5.1.4, “Accumulators,” and 3.5.4.3, “RWST,” match boron concentrations to the number of tritium producing burnable absorbers rods (TPBARs) installed in the reactor core. Watts Bar is authorized to place a maximum of ~~400~~ ***704*** TPBARs into the reactor in an operating cycle. Generally, TPBARs act as burnable absorber rods normally found in similar reactor core designs. However, unlike burnable absorber rods which lose their poison effects over the life of the cycle, some residual effect remains in the TPBARs at the end of the cycle. When larger amounts of excess neutron poisons (as in the case with larger loads of TPBARs) are added to a core, there is competition for neutrons from all the poison and the negative worth of each poison (including the reactor coolant system (RCS) boron) decreases. The positive reactivity insertion due to the negative moderator coefficient that occurs during the cooldown from hot full power to cold conditions following a loss of coolant accident (LOCA) must be overcome by RCS boron. Because the RCS boron is worth less, it takes a higher concentration to maintain subcriticality.

For a large break LOCA Analysis, the minimum water volume limit of 370,000 gallons and the minimum boron concentration limit is used to compute the post LOCA sump boron concentration necessary to assure subcriticality. This

(continued)