Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

10 CFR 50.90

AUG 1 8 2003

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

Gentlemen:

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

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - TECHNICAL SPECIFICATION (TS) CHANGE 03-02, "REVISION OF BORON REQUIREMENTS FOR COLD LEG ACCUMULATORS AND REFUELING WATER STORAGE TANK (RWST)" - RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (TAC NO.9480)

The purpose of this letter is to provide TVA's response to NRC's request for additional information (RAI) received via email on July 3, 2003, and to provide revised TS page markups. Subsequent to the receipt of the RAI, two telecons were held on July 8, and July 15, 2003, between TVA, NRC, and Westinghouse to discuss NRC's questions. As a result of these discussions, it was determined that TVA's initial amendment request dated May 30, 2003, required some modification.

TVA's initial amendment requested approval of varying boron concentrations in the RWST and CLAs depending upon the number of tritium producing burnable absorber rods (TPBARs) in the core. Part of the safety analyses for the amendment request credited control rod insertion for large cold leg break loss of coolant accidents. During NRC's review, it was noted that additional information would be required to support taking this credit. As a result, WBN has deleted this assumption in the attached analysis and provides revised boron concentrations for the RWST and CLAs corresponding to 0-240 number of tritium producing burnable absorber rods (TPBARs). Accordingly, TVA requests approval of the 0-240 TPBAR concentration number at this time to

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support the upcoming fall outage. Additional analyses and/or revised boron concentrations will be required in the future to support core loads up to and including the NRC approved maximum number of 2304 TPBARs.

Enclosure 1 provides the questions and TVA's response. Enclosure 2 provides revised marked-up pages needed to reflect this different approach along with the addition of a note to page 4.0-1 which places an upper limit of 240 for the number of TPBARs to be irradiated in the core based on the reasons given above.

As a result of this submittal, the table reflecting three boron concentrations have been reduced to a single one for 0-240 TPBAR core load. However, there is no change to the conclusion reached by No Significant Hazards Consideration previously provided in the initial amendment request. There are no regulatory commitments associated with this submittal. This letter is being sent in accordance with NRC Regulatory Issue Summary 2001-05, "Guidance on Submitting Documents to the NRC by Electronic Information Exchange or on CD-ROM." If you have any questions about this change, please contact me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 18th day of August 2003.

Sincerely,

P. L. Pace
Manager, Site Licensing
and Industry Affairs

Enclosures
cc: See page 3

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cc (Enclosures):

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ENCLOSURE 1
WATTS BAR NUCLEAR PLANT, UNIT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

I. **The licensees submittal states that, "Westinghouse has performed calculations within similar constraints as used for the tritium production amendment but has included an additional potential unborated water inleakage into containment as described in TVA letter dated March 24, 2003 (WBN-TS-03-06)...."**

A. **Please discuss exactly what is meant by "within similar constraints." Is the methodology used to perform the analyses for the proposed license amendment request (LAR) identical to that described in Section 2.15.5.4 of the licensees tritium core topical report (Westinghouse Report NDP-00-0344)?**

RESPONSE:

The methodology used in the current calculations is, in large part, the same as the analysis reported in NDP-00-0344. The differences are in the details of the inputs to the calculations and are principally associated with the potential for a small post accident unborated water leak as described in WBN technical specification change request TVA-WBN-03-06 dated March 24, 2003. The impact of the unborated water leak was not recognized until differences between TVA and Westinghouse calculations were questioned in preparation for submittal of initial amendment request on May 30, 2003. As such, they remain conservative with respect to assuring post accident subcriticality. The differences are listed in the following table

Input Assumption for NDP-00-0344	Input Assumptions for TVA-WBN-TS-03-02
No unborated water sources.	40 gpm unborated source over 16 hr.
Mass of ice melt after switchover to cold leg recirculation not included.	Maximum ice melt assumed.
RWST volume sent to containment spray not credited	Partial credit taken for containment spray volume
Reactor cavity volume not considered part of active sump. Volume of reactor cavity	Reactor cavity volume to support partial credit for containment spray volume.

considered to be covered by volume of containment spray.	
	Considers containment/ active sump volume vs. elevation to support partial credit for containment spray.

B. Please discuss the analysis assumptions with respect to the additional unborated water sources from the cooling water lines. For example, what dilution flowrates are assumed? Did the analyses assume 1 essential raw cooling water system (ERCW) and 2 component cooling system (CCS) lines failing? Please discuss how the assumptions used are conservative.

RESPONSE:

The analysis assumes 40 gpm unborated water is admitted into containment for up to 16 hours. This is a result of piping interactions with LOCA pipe whip and/or jet interactions following a large break LOCA in combination with a single design basis failure of an outboard containment isolation valve to close. Since a single failure is required in addition to the interaction inside containment, only one line is required to be failed for any LBLOCA event. This design basis issue is described in WBN technical specification change request TVA-WBN-03-06 dated March 24, 2003. The flow rate and time selected bound the worst case of the potential line failures.

II. The licensee has deleted the case of TPBAR failure with no control rod insertion from the methodology used to determine the effect of TPBARs on Post-LOCA sump boron concentration.

A. Do all the cases analyzed and listed in Table 1 of the licensee's submittal assume control rod insertion? If so, how would the accumulator and RWST boron concentration requirements be different if control rod insertion is not credited in these cases? Would adequate margin

to criticality exist with the current and proposed accumulator and RWST boron concentrations?

RESPONSE:

The critical boron concentrations in Table 1 are for the limiting case evaluated. The table has been revised to be consistent with an assumption of no control rod insertion for the 0-240 TPBAR case. This is the standard licensing basis calculation that is routinely performed for each reload core design. When TPBAR failure is assumed, but control rod insertion is credited, the resulting subcriticality margin is very large, > 200 ppm. If control rods are not credited, then the cases that assume TPBAR failure become limiting, and the RWST and CLA boron concentrations have to be increased to provide additional subcriticality margin. This has been done for the 0-240 TPBAR case being requested for approval.

B. **The licensee's submittal states that, "the Westinghouse methodology credits control rod insertion during a cold leg LOCA break." Please provide the basis for crediting control rod insertion for the LBLOCA cases. Also provide a reference to this NRC approved methodology, if available.**

RESPONSE:

This question relates to control rod insertion credit. The revised table provided no longer credits this action. A future submittal will be required to provide a discussion of this methodology specific to WBN in support of core loads up and including the NRC approved maximum number of 2304 TPBARs. The following is provided as background information:

The D. C. Cook Nuclear Power Plant submitted a change request under TAC numbers MA6473 and MA6474 based on WCAP-15245/15246-A which was approved by the NRC staff. This formed the basis for a Westinghouse Owners Group program which concluded that the methodology approved by the staff could be applied to other 3 and 4 loop Westinghouse PWRs. The Owners Group task generated WCAP-15704 which provided the technical analysis to extend this method to other Westinghouse PWRs.

C. Please provide technical justification for the assumption of control rod insertion during a LBLOCA for WBN Unit 1. In accordance with 10 CFR 50, Appendix K and NUREG-0800, "Standard Review Plan," appropriate analyses must be presented to support any credit taken for control rod insertion.

RESPONSE:

A future submittal for NRC's review will be required to provide additional information in support of core loads beyond 240 TPBARs. No credit is taken for control rod insertion in the 0-240 TPBAR case provided in this RAI response.

D. Section 2.15.5.4 of the licensee's tritium core topical report (Westinghouse Report NDP-00-0344) states that the Westinghouse Owners Group has a program underway to document credit for control rod insertion during a cold leg LBLOCA. The staff is not aware of this program. Please provide information and status regarding this effort.

RESPONSE:

This program is now complete as described above. A future submittal for NRC's review will be required to provide additional information in support of core loads beyond 240 TPBARs.

III. Regarding the analyses performed in support of this LAR and the results provided in Table 1 of the licensees submittal:

A. Please provide a description of the three cases listed in Table 1 of the submittal. For example, what are the assumptions used in these analyses? Are limiting and conservative assumptions used? Are these cold leg or hot leg breaks, are they large or small breaks? The licensee does not describe what these cases are.

RESPONSE:

The table was collapsed to one case. Only the 0-240 case is being requested at this time. The analyses performed are for large breaks. For the subcriticality assessment, the following assumptions were used:

Cold Leg Break (limiting case)(for 0-240 TPBARs)

- TPBAR failure for all interior TPBARs with 50% leaching and 12 inches of TPBAR pellet loss
- Peak Xenon prior to the LOCA to minimize the RCS boron concentration
- Conservative xenon credit is assumed in the critical boron calculation.
- No control rod insertion
- Cycle burnup corresponding to maximum core reactivity
- Cold conditions
- Sump boron at the time of Hot Leg Switchover (HLSO) (includes sump dilution effects)

The values in Table 1 represent the limiting case. For the cold leg break case, the TPBAR failure assumptions are conservative since leaching of the TPBAR is not instantaneous. The expected leaching rate is 3% per day; therefore, less than 1% of the lithium would have leached at the time of HLSO (3 hours). We are assuming 50% leaching.

B. Is the sump boron concentration listed in Table 1 calculated assuming the minimum requirements for accumulator and RWST boron concentrations?

RESPONSE:

The RWST and accumulator boron concentrations used in the calculations are the Tech Spec minimums listed in Table 1.

C. Please discuss the technical basis for an upper limit on the two proposed accumulator and RWST boron concentration ranges. Why is the already approved upper limit of 3800 ppm not used?

RESPONSE:

It is possible to use the upper boron limit for each of the previously proposed TPBAR ranges. However, the higher boron concentrations require changes in the plant. The current irradiation schedule does not require irradiation of large numbers of TPBARs in the near future. For this reason, TVA has elected to not implement some of the changes required for the higher boron concentration values until a later time. Therefore, an upper limit has been proposed for each TPBAR irradiation category. This upper limit precludes the use of the higher concentrations until required and allows for later implementation of the associated changes.

D. Please discuss the computer codes used to perform these analyses. Section 2.15.5.4 of the licensees tritium core topical report (Westinghouse Report NDP-00-0344) does not discuss the codes used.

RESPONSE:

The codes used for the subcriticality assessment are the PHOENIX-P and ANC code versions that have TPBAR modeling capability. These are described in Section 2.4.3.1 of NDP-00-0344, Rev. 1. SKBOR is used to calculate sump dilution at HLSO. It is an internal

Westinghouse code that calculates boil off in the core, thereby diluting the sump.

IV. **The licensee's submittal states that an additional dilution source is considered in the analyses and has deleted the case for TPBAR failure with no control rod insertion. However, the current accumulator and RWST minimum and maximum boron concentrations for a full tritium producing core with the maximum 2304 TPBARs are not being revised. Was this case reanalyzed to consider these changes? Why do the boron concentrations for the maximum TPBAR core (2304 TPBARs) remain adequate?**

RESPONSE:

This question was withdrawn by NRC based upon a telecon on July 8, 2003.

V. **Please provide a discussion of the impacts of the proposed accumulator and RWST boron concentrations on any non-LOCA transients which credit these systems and their boron concentrations.**

RESPONSE:

The only events that model the related boron concentrations are the feedline break, steamline break, and inadvertent ECCS events. Of these events, the feedline break and steamline break are not adversely affected by an increase in the concentrations as it is conservative to model lower concentrations in these events. The inadvertent ECCS event has been evaluated for Watts Bar Unit 1 as part of the TPBAR program to demonstrate that the event is not affected by an increase to the concentrations.

VI. Please provide a discussion of the impacts of the proposed accumulator and RWST boron concentrations on the time to switchover to hot leg recirculation. Discuss why the 3 hour switchover time requirement approved in Amendment No. 40 to WBN (NRC letter dated September 23, 2002) remains adequate.

RESPONSE:

During the NRC Staff review of the tritium amendment (Technical Specification change TVA-WBN-TS-00-015 subsequently approved by NRC as Amendment 40), discussions on the methodology for hot leg switchover were held between TVA and the NRC Staff. As a result of those discussions Westinghouse modified its standard analysis to address Staff concerns. This resulted in a proposed switchover time of 3 hours as documented in TVA letter dated July 30, 2002, "Watts Bar Nuclear Plant - Tritium Production - Post LOCA Hot Leg Emergency Core Cooling System (ECCS) Recirculation time - Supplemental Information (TAC No MB 1884) and in section 3.2.1 of the staff SER for the TPBAR amendment. The 3 hour switchover time is a function of several variables including the boron concentration in the RWST. As the boron concentration in the RWST increases, the required time for hot leg recirculation decreases. Since the maximum TBPAR case (2304 TPBARS) requires the highest RWST boron concentration of 3800 ppm, the 3 hours is bounding for that category and lower TPBAR quantities. Rather than readdress this switchover issue for lower numbers of TPBARs and lower RWST boron concentration, and since operator training and procedures were best served by implementing one change for all TPBARs quantities, WBN decided to retain use of the 3 hour switchover time as a conservative requirement.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

VII. Section 4 of the LAR submittal states that the required boron concentration considers the "reactivity holddown effect," and the effects of possible leaching of lithium following a LOCA. Please provide a description of how these effects impact the boron concentration requirements, and provide representative values which demonstrate the magnitude of the impact on the required boron concentration.

RESPONSE:

The subcriticality calculations for the cold leg break case considered TPBAR failure. It is assumed that 12 inches of pellets are lost and 50% of the lithium instantaneously leaches from the TPBARs. Since the lithium in the TPBARs reduces core reactivity (reactivity holddown), loss of this material has the effect of increasing core reactivity and the critical boron concentration at post-LOCA conditions. For a case with the maximum number of TPBARs (2304), the effect of leaching and pellet loss was an increase of 336 ppm in the critical boron concentration at the limiting burnup step. For the 0-240 case, with a smaller number of TPBARs, the critical boron increase is proportionally smaller - less than 40 ppm.

Since the RWST and CLA volumes represent only a portion of the fluid that is mixed in the sump, their boron concentrations would have to increase by more than the values above to have comparable subcriticality margin at both the time of HLSO and in the long term.

VIII. The licensee proposes to add a note to the TSs stating that the number of TPBARs in the reactor core is contained in the COLR for each fuel cycle. This is a change in that the original LAR for WBN added the maximum number of 2304 TPBARs to TS 4.2.1, and stated that the specific number of TPBARs to be irradiated during a given operating cycle would be identified in the Reload Safety Evaluation Report. This change must be evaluated by the staff as a proposal to relocate a cycle-specific parameter from the TSs to the COLR. As such, the licensee should provide proposed changes for all associated TS and COLR pages. These changes must be in accordance with the requirements of NRC Generic Letter 88-16, "Removal of Cycle Specific Parameter limits from Technical Specifications," dated October 3, 1988, which includes referencing of NRC approved methodologies in the COLR TS Administrative section, among other requirements.

RESPONSE:

The number of TPBARs is an input to the analysis used to determine the operating limits for the reactor core. The analysis models found in TS 5.9.5, "Core Operating Limits," use the TPBAR quantity as a core property similar to the enrichment of the fuel rods and the number and placement of burnable poison rods. The number of TPBARs is not a result of the analysis for the core nor is it a variable that can be monitored or controlled by the plant operators. The other parameters that are determined by these analysis models and are controlled during the fuel cycle are listed in TS 5.9.5 and are associated with specific TS sections. The TSs require these parameters to be controlled within the COLR requirements. Therefore, since the number of TPBARs is not a parameter that is controlled during a fuel cycle but is used as an input to the analysis that determines core operating limits, this number does not apply to Section 5.9.5 of the TSs. It is appropriate for the TPBAR number to be placed in the COLR because this document is readily available to the operators and is cycle specific. This ensures that the operators can quickly determine the quantity of TPBARs for compliance with the proposed boron concentration requirements and that they are applicable to the current core operating cycle. However, since TVA is only requesting approval of a 0-240 TPBAR boron case at this time, we have also added the limit of 240 TPBARs to Technical Specification 4.2.1.

ENCLOSURE 2
WATTS BAR NUCLEAR PLANT, UNIT 1

REVISED TECHNICAL SPECIFICATION PAGE MARKUPS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each accumulator isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each accumulator is ≥ 7630 gallons and ≤ 8000 gallons.	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each accumulator is ≥ 610 psig and ≤ 660 psig.	12 hours
SR 3.5.1.4	Verify boron concentration in each accumulator is ≥ 3500 ppm and ≤ 3800 ppm.	31 days **AND** -----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

(continued)

REVISE AS FOLLOWS:

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:

Number of TPBARs	Boron Concentration Ranges
0-240*	≥ 3000 ppm and ≤ 3300 ppm

ADD NOTE:

The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle. *The number of TPBARs is limited to no more than 240 based on TVA to NRC Letter dated August 18, 2003.

BASES

APPLICABLE SAFETY ANALYSES (continued)

water volume is the same as the deliverable volume for the accumulators, since the accumulators are emptied, once discharged. The safety analysis assumes values of 7518 gallons and 8191 gallons. To allow for instrument inaccuracy, values of 7630 gallons and 8000 gallons are specified.

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The minimum boron concentration setpoint is used in the post LOCA boron concentration calculation. The calculation is performed to ~~assure reactor subcriticality in a post LOCA~~ environment. Of particular interest is the large break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post LOCA shutdown and an increase in the maximum sump pH. The maximum boron concentration is used in determining the cold leg to hot leg recirculation injection switchover time and minimum sump pH.

The small break LOCA analysis is performed at the minimum nitrogen cover pressure, since sensitivity analyses have demonstrated that higher nitrogen cover pressure results in a computed peak clad temperature benefit. The maximum nitrogen cover pressure analysis limit of 690 psig prevents accumulator relief valve actuation, and ultimately preserves accumulator integrity. The LOCA analyses support a range of 585 to 690 psig. To account for the accumulator tank design pressure rating, and to allow for instrument accuracy values of ≥ 610 psig and ≤ 660 psig are specified for the pressure indicator in the main control room.

The effects on containment mass and energy releases from the accumulators are accounted for in the appropriate analyses (Refs. 2 and 4).

(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	Verify RWST boron concentration is ≥ 3600 ppm and ≤ 3800 ppm.	7 days

REVISE AS FOLLOWS:

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:

Number of TPBARs	Boron Concentration Ranges
0-240*	≥ 3100 ppm and ≤ 3300 ppm

ADD NOTE:

The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle. *The number of TPBARs is limited to no more than 240 based on TVA to NRC Letter dated August 18, 2003.

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 2304 Tritium Producing Burnable Absorber Rods into the reactor in an operating cycle.*

INSERT
(*The number of Tritium Producing Burnable Absorber Rods is limited to 240 based on TVA to NRC Letter dated August 18, 2003.

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.

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