October 8, 2003

Mr. J. A. Scalice
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 — ISSUANCE OF AN AMENDMENT REGARDING REVISION OF BORON REQUIREMENTS FOR COLD LEG ACCUMULATORS AND REFUELING WATER STORAGE TANK (TAC NO. MB9480)

Dear Mr. Scalice:

The Commission has issued the enclosed Amendment No. 48 to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant (WBN), Unit 1. The amendment consists of changes to Technical Specifications (TS) 3.5.1, "Accumulators," TS 3.5.4, "Refueling Water Storage Tank," and TS 4.2.1, "Fuel Assemblies," and is in response to your application dated May 30, 2003, as supplemented by letters dated August 18, September 10, September 29, and October 3, 2003.

The revised TSs would revise the boron concentration requirements and limit the number of tritium producing burnable absorber rods that could be loaded and irradiated in the core to a corresponding value. The boron concentration requirements have been established to ensure adequate post-Loss of Coolant Accident subcriticality margin without credit for control rod insertion.

A copy of the safety evaluation is also enclosed. Notice of issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Margaret H. Chernoff, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures: 1. Amendment No. 48 to NPF-90
2. Safety Evaluation

cc w/enclosures: See next page

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TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 48
License No. NPF-90

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (the licensee) dated May 30, 2003, as supplemented by letters dated August 18, September 10, September 29, and October 3, 2003, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-90 is hereby amended to read as follows:

   (2) Technical Specifications and Environmental Protection Plan

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 48, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. TVA shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance, and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Allen G. Howe, Chief, Section 2
Project Directorate II
Division of Project Licensing Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: October 8, 2003

ATTACHMENT TO AMENDMENT NO. 48

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO. 50-390

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

Remove Pages	Insert Pages
3.5-2	3.5-2
3.5-10	3.5-10
4.0-1	4.0-1
B 3.5-26	B 3.5-26
B 3.5-27	B 3.5-27
B 3.5-28	B 3.5-28

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 48 TO FACILITY OPERATING LICENSE NO. NPF-90

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

By letter dated May 30, 2003, as supplemented by letters dated August 18, September 10, September 29, and October 3, 2003, the Tennessee Valley Authority (licensee) submitted a request for changes to the Technical Specifications (TSs) for Watts Bar Nuclear Plant (WBN), Unit 1. The requested changes would modify TS 3.5.1, "Accumulators," and TS 3.5.4, "Refueling Water Storage Tank (RWST)," to revise the minimum and maximum cold leg accumulator (CLA) and RWST boron concentration. The requested change would also add the cycle-specific number of Tritium Producing Burnable Absorber Rods (TPBARs) to the Core Operating Limits Report (COLR) and would limit the maximum number of TPBARs that can be loaded into the reactor core and irradiated to 240. The licensee is revising the corresponding TS 3.5.1 and 3.5.4 Bases pages to reflect this amendment.

The supplemental letters provided clarifying information that did not expand the scope of the original request or change the initial proposed no significant hazards consideration determination.

The U.S. Nuclear Regulatory Commission (NRC) staff issued WBN Unit 1 License Amendment No. 40 on September 23, 2002 (ADAMS Accession No. ML022540925). In this license amendment, the staff granted approval for WBN Unit 1 to load and irradiate a maximum of 2304 TPBARs in the reactor core for the purpose of producing tritium for the U.S. Department of Energy. In License Amendment No. 40, the staff approved an increase in CLA boron concentration from a range of 2400 to 2700 parts per million (ppm) to a range of 3500 to 3800 ppm, and an RWST boron concentration increase from a range of 2500 to 2700 ppm to a range of 3600 to 3800 ppm.

In support of License Amendment No. 40, the licensee supplied Westinghouse Report NDP-00-0344, Revision 1, "Implementation and Utilization of Tritium Producing Burnable Absorber Rods (TPBARS) in Watts Bar Unit 1." The report provided an assessment of the effects of the TPBARs on the accident analyses for Watts Bar Unit 1. In the assessment of the post-Loss of Coolant Accident (LOCA) subcriticality analysis for a cold leg break, the report states that with conservative assumptions, the expected subcriticality margin at the limiting time in life was 8 ppm with no credit for control rod insertion. In this amendment, the boron concentration requirements have been established to ensure adequate post-LOCA subcriticality margin without credit for control rod insertion.

2.0 REGULATORY EVALUATION

Title 10, *Code of Federal Regulations* (10 CFR), Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR Part 50, Appendix K, "ECCS Evaluation Models," specify the requirements for the design and analysis of emergency core cooling systems (ECCS). These regulations ensure adequate core cooling following a loss-of-coolant-accident (LOCA) such that specified acceptance criteria are satisfied. The specified acceptance criteria include peak clad temperature, total cladding oxidation, total hydrogen generation, maintaining a coolable core geometry and ensuring adequate long-term core cooling. The applicable acceptance criterion for this license amendment is the long-term core cooling criterion. This criterion requires that the core temperature be maintained at an acceptably low value and that decay heat be removed for the extended period of time required by the long-lived radioactive nuclides remaining in the core.

The post-LOCA long-term core cooling analysis for WBN Unit 1 requires that the core remain subcritical considering that all boration sources are injected and mixed in the containment sump. These boration sources include the CLAs, the RWST, and the melted ice from the ice condenser containment. The minimum boron requirement for the CLAs ensures that the reactor core will remain subcritical during the post-LOCA recirculation phase by ensuring sufficient boron concentration in the post-LOCA sump. 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 (RCS) cooldown.

3.0 TECHNICAL EVALUATION

The licensee proposes to reduce the current boron concentration requirement. To support this reduction, the licensee also proposes to limit WBN Unit 1 to operation with a maximum of 240 TPBARs. The licensee further intends to include a table that will define the minimum and maximum boron concentration required for accident mitigation based on the actual number of TPBARs loaded in the core. The licensee proposes to add a note to each of the TS sections stating that the current number of TPBARs loaded in the core for each operating cycle can be found in the COLR.

3.1 Proposed CLA and RWST Boron Concentration Changes

The proposed TS boron concentration values are as follows:

No. of TPBARs	CLA Boron minimum (ppm)	CLA Boron maximum (ppm)	RWST Boron minimum (ppm)	RWST Boron maximum (ppm)
0 - 240	3000	3300	3100	3300

In support of the requested changes to the boron concentration requirements, the licensee performed analyses using the NRC approved Westinghouse computer codes PHOENIX-P and ANC to verify that the proposed boron concentration ranges are adequate to maintain subcriticality following a LOCA. The methodology and analyses performed to support the proposed boron concentration limits are within the same constraints as previously approved. This methodology is described in Westinghouse Topical Report NDP-00-0344, Revision 1, which was submitted to the staff in support of the WBN License Amendment No. 40. The

licensee's analyses included conservative reactivity assumptions regarding TPBAR failures, Xenon, cycle burnup, and no credit for control rod insertion.

The licensee's analyses also assumed an additional unborated water leakage source into containment. The analyses conservatively assumed that 40 gallons per minute of unborated water is admitted into containment for up to 16 hours.

The licensee provided descriptions of the analyses performed, including quantitative results. The licensee's results demonstrate that the proposed minimum RWST and CLA boron concentration values are adequate to maintain subcriticality. The licensee's long-term analyses demonstrate a subcriticality margin of 135 ppm. Based on the results of the analyses, the NRC staff finds that the proposed RWST and CLA boron concentration values are adequate to ensure that the core remains subcritical, post-LOCA, considering that all boration sources are injected and mixed in the containment sump, with no credit for control rod assembly insertion.

In support of License Amendment No. 40, the licensee evaluated the impacts of the maximum CLA and RWST boron concentration ranges (up to 3800 ppm) on the LOCA analyses. For both the large break LOCA (LBLOCA) and small break LOCA (SBLOCA), the licensee stated that the increased CLA and RWST boron concentrations would not adversely impact the LOCA analysis results (Reference 9). For the LBLOCA analysis, there was no increase in the peak clad temperature (PCT). For the SBLOCA, the licensee stated that the analysis did not explicitly model the boron concentration levels present in the CLAs or RWST. However, although not modeled in the analyses, any additional boron injected due to the increased concentration levels would increase the margin by which the core is maintained subcritical. The calculated PCT is not a function of the boron concentration. Therefore, the increased levels of CLA and RWST boron concentration will not adversely impact the PCT results for the LBLOCA and SBLOCA. The staff finds that the same logic applies, and the conclusion remains valid for the proposed CLA and RWST boron concentration range.

With respect to post-LOCA long-term core cooling requirements, in support of License Amendment No. 40, the licensee provided a summary of the hot leg switchover (HLSO) time evaluation model it used to establish that boric acid will not precipitate in the long term following certain LOCAs. The model is consistent with the traditional 1975 model applicable to Westinghouse-designed nuclear steam supply systems. Additionally, the licensee provided a discussion of conservatisms and nonconservatisms associated with the model. Predicted times available for initiation of hot leg injection included the following:

Case	Case Description	HLSO Time, hours
1	Traditional analysis with no allowance for boric acid saturation concentration uncertainty	7.23
2	Traditional analysis with allowance for boric acid saturation concentration uncertainty	5.56
3	Case 1 with Appendix K decay heat generation rate assumption	5.38
4	Case 2 with Appendix K decay heat generation rate assumption	4.16

Based on this information, the licensee stated in its previous application for Amendment No. 40 that ". . . the WBN emergency operating procedures will be revised to require initiation of hot

leg ECCS recirculation 3 hours following a large break LOCA for the tritium production core rather than 5.5 hours. The 3-hour switchover time requirement does not increase operator burden during LOCA mitigation and recovery and will provide an added measure of conservatism with respect to the tritium production core long-term cooling analysis." The staff approved the 3-hour switchover time in License Amendment No. 40. The staff finds that this time remains valid for the proposed CLA and RWST boron concentration ranges because the switchover time is conservative for the proposed, lower boron concentrations.

In support of License Amendment No. 40, the licensee also evaluated the impacts of the increased CLA and RWST boron concentrations on non-LOCA transients. The WBN events that model the CLA or RWST boron concentrations include the feedline break, steamline break, and inadvertent ECCS actuation. The feedline break and steamline break analyses conservatively assume a minimum boron concentration and are not adversely affected by the proposed increase in CLA and RWST boron concentrations. The licensee evaluated the inadvertent ECCS actuation event and demonstrated that the event is not adversely affected by the increased boron concentration. The staff finds that these conclusions remain valid for the proposed CLA and RWST boron concentration ranges.

Based on this discussion, the NRC staff concludes that the proposed CLA and RWST boron concentration ranges are acceptable. Furthermore, the staff considers acceptable the proposed limitation on operation to a maximum of 240 TPBARs. An amendment request, including post-LOCA subcriticality analyses and boron concentration requirements, is required to load and irradiate more than 240 TPBARs in the reactor core.

3.2 Placement of Cycle Specific Number of TPBARs in COLR

The licensee proposes to add a note to TSs 3.5.1 and 3.5.4 stating that the current number of TPBARs loaded in the core for each operating cycle can be found in the COLR. WBN License Amendment No. 40 stated that the cycle-specific parameter value would reside in the Reload Safety Evaluation Report. The number of TPBARs to be loaded in any WBN core is a cycle-specific parameter. The number is used as an input to the analyses that determine core operating limits.

The staff finds that it is acceptable to place the TPBAR number in the COLR since 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 CLA and RWST boron concentration requirements.

The licensee is revising the appropriate Bases changes to reflect the changes in the TS. The staff has no objections to these changes.

4.0 SUMMARY

The staff has completed its review of the proposed WBN TS changes associated with TS Sections 3.5.1, "Accumulators," 3.5.4, "Refueling Water Storage Tank," and 4.2.1, "Fuel Assemblies." The staff finds that the proposed CLA and RWST boron concentration ranges are acceptable for reactor operation with a maximum of 240 TPBARs, and that the number of TPBARs loaded in the reactor core can be added to the COLR.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (68 FR 40720). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (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.

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Date: October 8, 2003

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