NRR-058

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

March 14, 2000

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT REGARDING CHANGE TO A MORE NEGATIVE MODERATOR TEMPERATURE COEFFICIENT (TS 98-005) (TAC NO. MA6780)

Dear Mr. Scalice:

The Commission has issued the enclosed Amendment No. 20 to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant, Unit 1. This amendment is in response to your application dated September 30, 1999, as supplemented February 29, 2000. The amendment revises the Technical Specifications (TS) to change the TS analytical methods for core operating limits to implement an analysis supporting a more negative moderator temperature coefficient for the end of cycle, rated thermal power condition. This alternate methodology is based on a Westinghouse Electric Company analysis documented in reports WCAP-15088-P, Revision 1 (proprietary), "Safety Evaluation Supporting a More Negative EOL Moderator Temperature Coefficient Technical Specification for the Watts Bar Nuclear Plant," and WCAP-15089, Revision 1 (non-proprietary, same title).

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/
Robert E. Martin, Senior 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. 20 to NPF-90
2. Safety Evaluation

cc w/enclosures: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Sincerely,

Robert Martin

Robert E. Martin, Senior Project Manager, Section 2
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 20
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 September 30, 1999, as supplemented February 29, 2000, 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 Appendix A, as revised through Amendment No. 20 , 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, to be implemented no later than 30 days of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Richard P. Correia, 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: March 14, 2000

ATTACHMENT TO AMENDMENT NO. 20

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO. 50-390

Replace the following page of the Appendix A Technical Specifications with the attached page. The revised page is identified by amendment number and contains vertical lines indicating the area of change.

Remove Page	Insert Page
5.0-32	5.0-32

5.9 Reporting Requirements (continued)

5.9.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to the initial and each reload cycle, or prior to any remaining portion of a cycle, and shall be documented in the COLR for the following:

LCO 3.1.4 Moderator Temperature Coefficient
LCO 3.1.6 Shutdown Bank Insertion Limit
LCO 3.1.7 Control Bank Insertion Limits
LCO 3.2.1 Heat Flux Hot Channel Factor
LCO 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor
LCO 3.2.3 Axial Flux Difference
LCO 3.9.1 Boron Concentration

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. WCAP-9272-P-A, WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY", July 1985 (W Proprietary). (Methodology for Specifications 3.1.4 - Moderator Temperature Coefficient, 3.1.6 - Shutdown Bank Insertion Limit, 3.1.7 - Control Bank Insertion Limits, 3.2.1 - Heat Flux Hot Channel Factor, 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor, 3.2.3 - Axial Flux Difference, and 3.9.1 - Boron Concentration.

2. WCAP-10266-P-A, Rev 2, "The 1981 VERSION OF WESTINGHOUSE EVALUATION MODEL USING BASH CODE," March 1987. (W Proprietary). (Methodology for Specification 3.2.1 - Heat Flux Hot Channel Factor).

3. WCAP-10216-P-A, Revision 1A, "RELAXATION OF CONSTANT AXIAL OFFSET CONTROL F(Q) SURVEILLANCE TECHNICAL SPECIFICATION," February 1994 (W Proprietary).(Methodology for Specifications 3.2.1 - Heat Flux Hot Channel Factor (W(Z) Surveillance Requirements For F(Q) Methodology) and 3.2.3 - Axial Flux Difference (Relaxed Axial Offset Control).)

4. WCAP-12610-P-A, "VANTAGE + FUEL ASSEMBLY REFERENCE CORE REPORT," April 1995. (W Proprietary). (Methodology for Specification 3.2.1 - Heat Flux Hot Channel Factor).

5. WCAP-15088-P, Rev.1, "Safety Evaluation Supporting A More Negative EOL Moderator Temperature Coefficient Technical Specification for the Watts Bar Nuclear Plant," July 1999, (W Proprietary), as approved by the NRC staff's Safety Evaluation accompanying the issuance of Amendment No. **20** . (Methodology for Specification 3.1.4- Moderator Temperature Coefficient.)

(continued)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 20 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 September 30, 1999, as supplemented February 29, 2000 , the Tennessee Valley Authority (TVA, the licensee) submitted a request for changes to the Watts Bar Nuclear Plant (WBN), Unit 1, Technical Specifications (TS). The requested changes revise the TS analytical methods for core operating limits to implement an analysis supporting a more negative moderator temperature coefficient (MTC) for the end-of-cycle (EOC), rated thermal power (RTP) condition. This alternate methodology is based on a Westinghouse Electric Company (Westinghouse) analysis documented in topical report WCAP-15088, Revision 1 (proprietary), "Safety Evaluation Supporting a More Negative EOL Moderator Temperature Coefficient Technical Specification for the Watts Bar Nuclear Plant," July 1999, which was submitted with the amendment request. The WCAP report, and this NRC staff safety evaluation, are added to the list of references in TS 5.9.5(b) for the core operating limits report (COLR) as a U.S. Nuclear Regulatory Commission (NRC) approved methodology for determining the MTC required by TS 3.1.4. A non-proprietary version, WCAP-15089, Revision 1, was also submitted with the amendment request. The additional submittal dated February 29, 2000, did not change the initial proposed No Significant Hazards Consideration Determination or expand the application beyond the scope of the original notice.

2.0 EVALUATION

The purpose of TS 3.1.4 is to ensure that the most negative MTC at EOC remains within the bounds of the WBN Unit 1 safety analyses for those transients and accidents for which the analysis results are made more severe by assuming maximum moderator feedback. MTC is a parameter which can be determined from measurement of plant conditions while the parameter actually used in safety analyses calculations is the related moderator density coefficient (MDC). The relationship between the MTC and the MDC is expressed by a simple calculation which accounts for the rate of change of MDC with temperature at the conditions of interest.

The safety analyses are performed assuming a constant value of the MDC of 0.43 $\Delta k/k$ per gm/cc. The surveillance requirements (SR) associated with TS 3.1.4 involve an MTC measurement at any thermal power within 7 effective full power days (EFPD) after reaching an equilibrium primary coolant boron concentration of 300 parts per million (ppm). In the event that the measured MTC at 300 ppm is more negative than the 300 ppm SR limit stated in the COLR, the MTC must be remeasured and compared with the EOC MTC limit once per 14 EFPD during the remainder of the cycle. The measurements need not be repeated if, at an equivalent RTP all rods out (ARO) equilibrium boron concentration of less than or equal to 60 ppm, the measured MTC is less negative than the 60 ppm surveillance limit in the COLR.

For the higher fuel enrichments and longer cycles used for WBN Unit 1, TVA anticipates that future measured values of MTC required near EOC may result in an MTC that will be more negative than the SR limit. This will then require TVA to make MTC measurements once every

14 EFPD until EOC. Failure to meet the SR MTC does not necessarily mean that either the most negative MTC that would occur near EOC would be exceeded or that the safety analysis MTC would be exceeded. TVA states that these additional MTC measurements, if needed to comply with the SR, would be an undue burden to the operation of WBN Unit 1.

The current EOC MTC limit was derived by assuming that the most negative MTC that could occur was at EOC RTP conditions with all control rods fully inserted (ARI) even though the WBN TS do not allow operation under these conditions. The MTC under these conditions must be less negative than the MTC (actually moderator density coefficient, or MDC) used in the safety analysis. The current method used to determine the MTC limit is based on incrementally correcting the MDC used in the safety analysis to obtain the most negative MTC value or, equivalently, the most positive MDC at nominal hot full power (HFP) core conditions. The MTC is then equal to the product of the MDC times the rate of change of moderator density with temperature at RTP conditions. This method of determining the most negative MTC can result in an ARO MTC TS value which is significantly less negative than the MTC used in the safety analysis. This has the potential for requiring the plant to be placed in a hot shutdown condition by TS 3.1.4.C even though substantial margin to the safety analysis MDC exists.

WCAP-15088, Revision 1, provides an alternative method for adjusting the safety analysis MDC to obtain a most negative MTC. This method is termed the "most negative feasible" (MNF) MTC and is similar to that previously approved by the NRC for use at other nuclear power plants such as Sequoyah Units 1 and 2, South Texas Project, Vogtle, and Farley. The MNF MTC method seeks to determine the conditions for which a core will exhibit the most negative MTC value that is consistent with operation allowed by the TS. For example, the MNF MTC method would not require the conversion assumption of the ARI HFP condition but would require the conversion assumption that all control rod banks are inserted the maximum amount permitted by TS. The MNF MTC method is used to determine the EOC MTC sensitivities to those design and operational parameters that directly impact the MTC in such a way that the sensitivity to one parameter is independent of the assumed values for the other parameters. The parameters considered with this MNF MTC method include:

(1) soluble boron concentration in the coolant
(2) moderator temperature and pressure
(3) control rod insertion
(4) axial flux (power) shape
(5) transient xenon concentration

The MNF MTC approach uses this sensitivity information to derive an EOC ARO HFP MTC value based on the safety analysis value of the MDC. TVA states that this MNF MTC approach provides an MTC that would be sufficiently negative so that repeated MTC measurements from a 300 ppm core condition to EOC would not be required. The method does not change the safety analysis moderator feedback assumption so the safety analysis value of MDC is unchanged.

In WCAP-15088, Revision 1, Westinghouse determined the sensitivity of the five parameters listed above on the EOC MTC for the Cycle 2 WBN reload core. Additional conservatism was added to the results to bound future cycles. This was derived by comparing three other representative Westinghouse reload cores to WBN. The results of this comparison indicate that the sensitivities are cycle-independent.

The soluble boron concentration was not used in the sensitivity analysis because the EOC HFP ARO MTC TS value is assumed to be at 0 ppm of boron. The radial power distribution, which can vary under normal operation and affect the MTC, was not included either. The operational activities that affect the radial power distribution do so through the

movement of control rods and activities that affect the xenon distribution. The allowed changes in the radial power distribution are implicitly included in the MTC sensitivity to control rod insertion and xenon concentration.

As previously stated, the WBN Unit 1 safety analyses are performed using the MDC. For events sensitive to maximum negative moderator feedback, a constant value of the MDC of 0.43 Δk/k/gm/cc is assumed throughout the analysis. For HFP and full flow nominal operating conditions, the MTC equivalent to the MDC of 0.43 Δk/k/gm/cc is -5.59×10^{-4} Δk/k/ °F. TVA has stated that this safety analysis limit, as well as the 300 ppm and the 60 ppm SR, is overly restrictive because it is derived assuming deviations from nominal plant operation which are not permitted by TS. The MNF MTC approach is based on a determination of the extent to which a nominal EOC HFP ARO MTC value can be made more negative under the most extreme values of certain operational parameters that are permitted by other TS. This approach assumes that these largely independent extreme situations occur simultaneously, and in the worst case, serve to make the EOC HFP MTC somewhat more negative than it would be at nominal conditions. Using this approach, a TS value of -4.5×10^{-4} Δk/k/ °F was found to be a conservative EOC HFP MTC limit for WBN Unit 1.

Examination of the difference between the 300 ppm HFP equilibrium boron concentration MTC value and the EOC HFP MTC value indicates that a bounding expected difference between these two MTC values for WBN reload cores is -0.75×10^{-4} Δk/k/ °F. The proposed TS 300 ppm SR value of -3.75×10^{-4} Δk/k/ °F is obtained by subtracting this expected difference from the proposed -4.5×10^{-4} Δk/k/ °F EOC HFP MTC limit. Likewise, -0.22×10^{-4} Δk/k/ °F is the bounding expected difference between the 60 ppm HFP equilibrium boron concentration MTC value and the EOC HFP MTC value. This difference is subtracted from the proposed -4.5×10^{-4} Δk/k/ °F EOC HFP MTC TS limit to obtain the proposed TS 60 ppm HFP MTC SR value of -4.28×10^{-4} Δk/k/°F.

The proposed MNF method to determine the WBN Unit 1 TS values for EOC MTC as well as the 300 ppm and 60 ppm SR values should, therefore, alleviate the problems inherent with the present MTC limits in TS 3.1.4. Since TS 3.1.4 continues to require that the MTC surveillance be performed near EOC, any deviations between the operating core and design predictions that might threaten the validity of the safety analysis assumptions would be detected and appropriate action undertaken. The MNF method does not change the safety analysis moderator feedback assumption so the safety analysis value of MDC is unchanged.

3. SUMMARY

The NRC staff has reviewed the assumptions and basis for the MNF MTC method described above and concludes that they are acceptable because they will result in conservative most negative MTC LCO and SR values that could result from allowed operation of WBN Unit 1 from nominal conditions and because the MTC measurements at 300 ppm and 60 ppm of boron core conditions will assure, using the SR values of MTC, that the safety analysis MDC will not be exceeded. The method is a conservative and reasonable basis to assume for an MTC value of a reload core and is consistent with plant operation defined by other TS. The validity of these MTC values, as well as the WBN Unit 1 ability to comply with them, will be examined for each reload cycle as part of the normal reload design process.

Based on this, Westinghouse report WCAP-15088, Revision 1, together with this safety evaluation report, may be referenced in WBN TS Section 5.9.5(b) for the COLR as an approved methodology for TS 3.1.4, "Moderator Temperature Coefficient." To enable the approved version of WCAP-15088-P, Revision 1 to be reflected in TS 5.9.5, the licensee's supplementary letter dated February 29, 2000, adds the clause to TS 5.9.5.b.5 ". . . . as approved by the NRC staff's Safety Evaluation accompanying the issuance of Amendment No. 20 ."

4.0 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.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. 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 (65 FR 4291). 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.

6.0 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: March 14, 2000

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