July 25, 2006

Mr. Karl W. Singer
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 AMENDMENT REGARDING TECHNICAL SPECIFICATION CHANGE TO INCREASE CONTAINMENT ICE CONDENSER ICE WEIGHT TO SUPPORT REPLACEMENT STEAM GENERATORS (TAC NO. MC9270)

Dear Mr. Singer:

The Commission has issued the enclosed Amendment No. 62 to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant, Unit 1. This amendment is in response to your application dated December 15, 2005 (TS-05-09), as supplemented by letter dated June 7, 2006. The amendment will revise Watts Bar's Technical Specification Surveillance Requirements to increase the minimum required average ice basket weight and the corresponding total weight of the stored ice in the containment ice condenser. The changes to the ice basket and total ice weights are due to the additional energy associated with the replacement steam generators.

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/

Douglas V. Pickett, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures: 1. Amendment No. 62 to NPF-90
2. Safety Evaluation

cc w/enclosures: See next page

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Tennessee Valley Authority

WATTS BAR NUCLEAR PLANT

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TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 62
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 December 15, 2005, as supplemented by letter dated June 7, 2006, 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. , 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 prior to Mode 4 at startup to begin Cycle 8 fuel cycle.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Michael L. Marshall, Jr., Branch Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Operating License No. NPF-90 and
the Technical Specifications

Date of Issuance: July 25, 2006

ATTACHMENT TO AMENDMENT NO. 62

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO. 50-390

Replace page 3 of Operating License No. NPF-90 with the attached page 3.

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 areas of change.

Remove Page	Insert Page
3.6-29	3.6-29

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 62 TO FACILITY OPERATING LICENSE NO. NPF-90

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

By application dated December 15, 2005, as supplemented by letter dated June 7, 2006, the Tennessee Valley Authority (TVA, the licensee) proposed an amendment to the Technical Specifications (TS) for the Watts Bar Nuclear Plant (WBN), Unit 1. The requested changes would revise the TS Surveillance Requirements (SRs) to increase the minimum required average ice basket weight, and the corresponding total weight of ice in the WBN ice condenser. The changes to the ice basket and total ice weights are due to the additional energy associated with the Replacement Steam Generators (i.e., increased metal mass, primary and secondary volumes, and heat transfer areas).

Specifically, the licensee proposed changes to TS Section 3.6.11, "Ice Bed," SR 3.6.11.2 and SR 3.6.11.3 to raise the minimum required average ice basket weight from 1110 pounds (lbs) to 1237 lbs, and the corresponding total weight of the stored ice in the ice condenser from 2,158,000 lbs to 2,404,500 lbs. In addition, the licensee proposed editorial changes to SRs 3.6.11.2, 3.6.11.3 and 3.6.11.4 to replace inequality signs with words (i.e., # is replaced by “less than or equal to” and $ is replaced by “greater than or equal to”) and replace the % sign with the word “percent.”

The WBN containment ice bed consists of ice stored in 1944 baskets within the ice condenser. The primary purpose of the ice condenser is to provide a large heat sink in the event of a release of energy from a design-basis loss-of-coolant accident (LOCA) or other high energy line break in the containment. The LOCA requires the greatest amount of ice compared to other accident scenarios; therefore, the increase in ice weight is based on the LOCA analysis.

The ice would absorb energy and limit the containment peak pressure and temperature during a postulated accident. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a design-basis accident. The design-basis ice mass is supported by the containment integrity analysis documented in the WBN Updated Final Safety Analysis Report (UFSAR), Section 6.2, "Containment Systems." The TS surveillance limits on total ice weight, and average basket ice weight by row-group, are intended to ensure that sufficient ice is present in an appropriate

distribution to perform this function. The TS surveillance limits are currently an "as-left" measurement and include margin for ice sublimation.

In Enclosure 4 of the amendment request package, the licensee provided a LOCA long-term containment mass and energy release, and containment integrity analysis to support the steam generator replacement at WBN Unit 1. The stated objective of this effort was to provide revised containment mass and energy release data using current WBN specific information and the calculated reactor coolant system inventory based upon the new steam generators. The licensee stated that the analysis used the Westinghouse mass and energy release model which was documented in WCAP-10325-PA, "Westinghouse LOCA Mass and Energy Release Model for Containment Design," and approved by the NRC in a Safety Evaluation to Westinghouse dated February 17, 1987.

The licensee's letter dated June 7, 2006, provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

2.0 REGULATORY EVALUATION

Containment integrity analysis is performed during nuclear plant design to ensure that the pressure and temperature inside the containment will remain below the containment building design conditions if a high-energy line break inside the containment should occur during plant operation. The analysis ensures that the containment heat removal capability is sufficient to remove the maximum possible discharge of mass and energy to the containment from the Nuclear Steam Supply System without exceeding the acceptable criteria (design pressure and temperature).

In Section 5.2, Enclosure 1 of the amendment request package, the licensee stated that it has "evaluated [the proposed] change against the applicable NRC regulations and criteria. The change in the TS ice bed weights will not change the ice condenser function to respond as designed. These TS changes are, therefore, considered safe and meet the applicable regulatory requirements."

The staff's review was based on the acceptance criteria discussed in NUREG-0800, Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants, Section 6.2.1.1.B, "Ice Condenser Containments". According to Section 6.2.1.1.B of the SRP, the licensee must meet General Design Criteria (GDC) 16, 38, and 50, as described in Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A.

GDC 16 requires the containment to be designed as an essentially leak tight barrier that will withstand the most extreme accident conditions for the duration of any postulated accident. The containment must be able to withstand accidents because it is the final barrier against an uncontrolled release of radioactivity to the environment.

GDC 38 requires the establishment of a containment heat removal system that will rapidly reduce containment pressure and temperature following a LOCA. The containment heat removal system supports the containment function by minimizing the duration and intensity of the pressure and temperature increase following a LOCA, thus, lessening the challenge to containment integrity.

GDC 50 requires the containment structure and associated heat removal system to be designed with margin to accommodate any LOCA such that the containment design leak rate is not exceeded. A LOCA potentially causes the greatest pressure surge and release of fission products when compared to any other accident. Since it is the most severe challenge expected, the containment must be designed to withstand this accident. GDC 50 will ensure that containment integrity is maintained under the most severe accident conditions, thus, precluding an uncontrolled release of radioactivity to the environment.

Conformance with GDC Nos. 16, 38, and 50 is demonstrated by showing that the containment design pressure is not exceeded at any time during the accident transient and the containment heat removal systems function to rapidly reduce containment pressure and temperature.

3.0 TECHNICAL EVALUATION

The operability of the WBN ice condenser beds requires that the ice inventory be distributed evenly throughout the ice condenser bays in the containment and contain sufficient heat removal capability to condense the reactor coolant system volume released during a LOCA. Sufficient pressure suppression capability from the ice in the ice condenser is necessary to limit the containment peak pressure transient during a LOCA. The design pressure of the WBN containment is 13.5 pounds per square inch gauge (psig). The ice inventory is contained in 1944 ice baskets throughout the ice condenser.

Current TS SR 3.6.11.2 requires verification that the total weight of stored ice is greater than or equal to 2,158,000 lbs at a 95 percent confidence level. This is accomplished by weighing a representative sample of a minimum of 144 ice baskets and verifying that each basket contains a minimum of 1110 lbs of ice. The current 1110-lb TS limit is based on the licensee's analysis included in its application dated September 7, 2001, that was approved by the NRC in Amendment No. 33 to the WBN license dated November 29, 2001. That analysis assumes an even distribution of 1044 lbs per basket throughout the ice condenser at the time of a LOCA. The 1110 lbs per basket TS limit contains a 6 percent allowance for ice loss through sublimation during the surveillance interval. Average sublimation over 3 operating cycles is approximately 3.42 percent.

The licensee is proposing to increase the TS limits for the minimum average ice basket weight and the corresponding minimum total weight of ice in the ice condenser baskets to accommodate the additional energy associated with the replacement steam generators. The licensee stated that it has evaluated those postulated design-basis accidents that credit the ice condenser using the revised design-basis parameters. The licensee further states that the analysis provides assurance that containment heat removal capability is sufficient to remove the maximum calculated discharge of mass and energy to the containment without exceeding the containment pressure and temperature acceptance criteria. As indicated above, in Enclosure 4 of the amendment request package, the licensee provided a LOCA long-term containment mass and energy release and containment integrity analyses to support the proposed increase. The staff notes that the licensee has used the same methodology and computer codes for the revised mass and energy release and containment integrity analyses as in the previously approved September 7, 2001, analysis.

The SATAN VI, WREFLOOD, FROTH, and EPITOME computer codes were used to calculate the mass and energy analysis and the LOCTIC-1 computer code was used to calculate the

containment pressure response. The staff noted that the EPITOME computer code was not mentioned in the mass and energy release analysis in the 2001 analysis. In a supplemental letter dated June 7, 2006, the licensee confirmed that although not called out previously, EPITOME code has always been part of the Westinghouse methodology for mass and energy release analysis, including the September 7, 2001, analysis. The licensee indicated that the EPITOME code continues the FROTH post-reflood portion of the transient from the time at which the secondary side equilibrates to containment design pressure to the end of the transient.

The licensee calculated a new maximum containment pressure of 11.01 psig, up from 10.64 psig, for the design-basis LOCA analysis, assuming an ice bed weight of 2.26 million pounds. This pressure is less than the design pressure of 13.5 psig and, therefore, supports the proposed increase in the TS minimum required average ice basket weight from 1110 lbs to 1237 lbs, and the corresponding total weight of the stored ice in the ice condenser from 2,158,000 lbs to 2,404,500 lbs. The staff has verified that, consistent with WBN's current licensing basis, the proposed TS minimum values includes a 6 percent margin to bound expected sublimation over one cycle. The pressure peak occurred at approximately 6,562.8 seconds, with ice bed melt-out at approximately 3,685.1 seconds.

In addition to examining the bounding containment peak pressure and temperature events, the licensee addressed the following events:

- There is no adverse impact on the main steamline break (MSLB) accident analysis. This is because the MSLB does not melt the entire initial ice mass assumed in the MSLB analysis which is less than the ice melt calculated for the containment LOCA analysis. Thus, the LOCA analysis bounds the MSLB accident analysis and the proposed increase in total ice mass would have no effect on the MSLB accident analysis.

- There is no adverse impact on the LOCA peak clad temperature (PCT) analyses. This is because only a relatively minor amount of ice would be melted when the PCT is reached. Therefore, the proposed increase in total ice mass would have no effect on PCT.

- The post-LOCA subcriticality calculation conservatively assumes a maximum initial ice mass in the ice bed in order to minimize the sump boron concentration. However, since the new total ice weight remains substantially less than the value assumed in the calculation, the proposed increase in ice inventory would have no effect.

- The licensee has concluded that the minimum post-LOCA sump pH value will remain above 7.5. The sump pH above this value will not create a corrosion issue, and is acceptable with respect to minimizing the potential for chloride induced stress corrosion cracking and maintaining iodine retention in the sump solution.

- The staff reviewed the licensee's calculations that determined the maximum post-accident containment water level. The licensee calculated the maximum containment water level for the bounding LOCA analysis based upon the revised reactor coolant system volume and the increased mass of ice. The total analytical ice mass is being increased to 2,404,500 lbs. However, the licensee's calculation conservatively

assumed a value of 3,000,000 lbs. for flood level considerations. As a result of the increase in the reactor coolant system, the equilibrium level has increased from elevation 717.2 to 717.3 feet. The licensee evaluated all design changes to determine that no components required for safety are installed in this area. The maximum transient flood level inside the crane wall remains at elevation 720.0 feet. Therefore, the increased ice mass and reactor coolant system inventory do not cause any internal containment post-accident flooding concerns.

- Small break LOCA analysis are bounded by the design-basis large-break LOCA analysis. Therefore, the proposed increase in ice mass would have no effect.

Finally, the licensee has proposed editorial changes to SRs 3.6.11.2, 3.6.11.3 and 3.6.11.4 to replace mathematical signs with words. The inequality symbol # will be replaced by the words "less than or equal to," the inequality symbol $ will be replaced by the words "greater than or equal to," and the % sign will be replaced by the word "percent." These proposed changes are editorial in nature and are acceptable to the staff.

In summary, the licensee performed a new LOCA long-term containment mass and energy release analysis and a containment integrity analysis as part of its steam generator replacement activities at WBN. These analysis indicated that the TS required minimum average ice basket weight must be increased in order to ensure conformance with GDCs 16, 38, and 50 is maintained (i.e the containment design pressure is not exceeded at any time during a design-basis accident transient, and containment heat removal systems function properly to rapidly reduce the containment pressure and temperature). The staff has determined that the licensee has used previously approved methodologies in accordance with the criteria in Standard Review Plan Section 6.2.1.1.B, for ice condenser containment. Therefore, the staff finds the licensee's proposal to raise the TS minimum required average ice basket weight from 1110 lbs to 1237 lbs, and the corresponding total weight of the stored ice in the ice condenser from 2,158,000 lbs to 2,404,500 lbs to be acceptable.

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 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 (71 FR 7814). 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 this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Getachew Tesfaye, NRR

Date: July 25, 2006