

December 29, 2006

Mr. Karl W. Singer  
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Executive Vice President  
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SUBJECT: BROWN FERRY NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT  
REGARDING OSCILLATION POWER RANGE MONITOR  
(TAC NO. MC9565) (TS-443)

Dear Mr. Singer:

The Commission has issued the enclosed Amendment No. 266 to Renewed Facility Operating License No. DPR-33 for the Browns Ferry Nuclear Plant, Unit 1. This amendment is in response to your application dated January 6, 2006, as supplemented by letter dated October 2, 2006. This amendment revises the Technical Specifications to activate the thermal-hydraulic stability monitoring instrumentation, referred to as oscillation power range monitor.

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 by E. Brown for/**

Margaret H. Chernoff, Senior Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Enclosures: 1. Amendment No. 266 to  
License No. DPR-33  
2. Safety Evaluation

Docket No. 50-259

cc w/enclosures: See next page

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TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-259

BROWNS FERRY NUCLEAR PLANT UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 266  
Renewed License No. DPR-33

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Tennessee Valley Authority (the licensee) dated January 6, 2006, as supplemented by letter dated October 2, 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 Renewed Facility Operating License No. DPR-33 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 266, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

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

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

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

Attachment:  
Changes to the Operating License  
and Technical Specifications

Date of Issuance: December 29, 2006

ATTACHMENT TO LICENSE AMENDMENT NO. 266  
RENEWED FACILITY OPERATING LICENSE NO. DPR-33  
DOCKET NO. 50-259

Replace Page 3 of Renewed Operating License DPR-33 with the attached Page 3.

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

<u>REMOVE</u>	<u>INSERT</u>
3.3-1	3.3-1
---	3.3-2a
3.3-5	3.3-5
3.3-7	3.3-7
3.4-1	3.4-1
3.4-2	3.4-2
3.4-3	3.4-3
3.4-4	3.4-4

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 266

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-33

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-259

1.0 INTRODUCTION

By application dated January 6, 2006, as supplemented by letter dated October 2, 2006, the Tennessee Valley Authority (TVA, the licensee) submitted a request for changes to the Browns Ferry Nuclear Plant (BFN), Unit 1, Technical Specifications (TSs). The supplement dated October 2, 2006, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on April 25, 2006 (71 FR 23962). The requested changes would activate the thermal-hydraulic stability monitoring instrumentation.

2.0 EVALUATION

2.1 Description of Change

Under certain conditions, boiling-water reactors may be susceptible to coupled neutronic/thermal-hydraulic instabilities. These instabilities are characterized by periodic power and flow oscillations. If these power and flow oscillations become large enough, the fuel cladding integrity minimum critical power safety limit requirements may be challenged.

The Oscillation Power Range Monitor (OPRM) module of the Power Range Neutron Monitoring System (PRNMS) is designed to provide TVA's solution regarding reactor stability as requested by Generic Letter 94-02, "Long-term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling-Water Reactors."

To detect core instabilities automatically and provide a reactor scram signal to the reactor protection system (RPS), the licensee selected Boiling-Water Reactor Owners Group (BWROG) Stability Option III as the long-term stability system solution (LTSSS) for BFN, Unit 1. The LTSSS Option III approach consists of detecting and suppressing stability-related power oscillations by automatically inserting controls rods to terminate power oscillations.

## 2.2 Regulatory Evaluation

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications," provides the regulatory requirements for the content required in a licensee's TSs. As stated in 10 CFR 50.36, the TSs will include Surveillance Requirements (SRs) to assure that the limiting conditions for operation (LCO) will be met.

At the time BFN was licensed, 10 CFR Part 50 Appendix A, "General Design Criteria (GDC) for Nuclear Power Plants," was not incorporated in the NRC regulations. BFN conformed to the draft Proposed GDC 27 (Units 1 and 2) and draft Proposed GDC 70 (Unit 3) criteria current at the time of the BFN design. The design bases of each unit of this plant were reevaluated against the draft Proposed GDC 70 criteria current at the time of operating license application. It was concluded that each unit of this plant conforms with the intent of the GDC for Nuclear Power Plant Construction Permits. The references to the criteria below refer to these proposed GDC, not the GDC in Appendix A of 10 CFR Part 50.

Draft proposed Criterion 6, "Reactor core design," states that the reactor core shall be designed to function throughout its design lifetime, without exceeding acceptable fuel damage limits that have been stipulated and justified. The core design, together with reliable process and decay heat removal systems, shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations that can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all offsite power.

Draft proposed Criterion 7, "Suppression of power oscillations," states that the core design, together with reliable controls, shall ensure that power oscillations which could cause damage in excess of acceptable fuel damage limits are not possible or can be readily suppressed.

The licensee selected BWROG Stability Option III as the LTSSS for BFN Unit 1. The LTSSS Option III approach consists of detecting and suppressing stability-related power oscillations by automatically inserting control rods (scramming) to terminate power oscillations, thereby complying with the requirements of the draft proposed criteria 6 and 7.

The General Electric (GE) NUMAC-PRNMS design was approved by the NRC staff in its safety evaluation (SE) of GE licensing topical report (LTR) NEDC-32410P, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC-PRNM) Retrofit Plus Option III Stability Trip Function," dated September 5, 1995. The SE was subsequently included in the approved version of the LTR (Agencywide Documents Access and Management System Accession No. ML9605290009). Supplement 1 of the LTR was approved by the NRC staff in its SE dated August 15, 1997. The SE was subsequently included in the approved Supplement 1 of the LTR (ML9806120242). The LTR and Supplement 1 address the BWR power instability issue discussed in GE licensing topical report NEDO-31960, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology" (ML9106100443).

The licensee stated in the submittal that "the OPRM is designed to meet all requirements of General Design Criteria (GDC) 10 and 12 by automatically detecting and suppressing design basis thermal-hydraulic power oscillations prior to challenging the fuel Minimum Critical Power Ratio (MCPR) Safety Limit". However, the NRC staff, in a telephone discussion with the

licensee, confirmed that the licensee did not intend to adopt the final GDC 10 and 12 in Appendix A of 10 CFR Part 50, but maintain the current licensing basis of draft GDC 6 and 7.

### 3.0 TECHNICAL EVALUATION

The OPRM module of the PRNMS is designed to detect the onset of reactor core power oscillations resulting from thermal-hydraulic instability and suppress them by initiating a reactor scram via the RPS trip logic. The design was approved by the Nuclear Regulatory Commission (NRC) staff in its SE of GE licensing topical report, Document No. NEDC-32410P. Installation of the hardware was reviewed and approved as discussed in an NRC SE dated September 27, 2006.

TVA has requested to operate the OPRM module in the "armed" mode when the unit returns to power operations. The NRC staff approved an initial period for OPRM confirmatory testing in the SE of NEDC-32410P-A. BFN Units 2 and 3 are similar to BFN Unit 1 and have been operating with the OPRM Option III system enabled since the spring of 1999 and 2000, respectively. Therefore, based on the licensee's experience with OPRM on BFN Units 2 and 3, the NRC staff finds it acceptable to activate the OPRM on BFN Unit 1 without the need for confirmatory testing.

By letter dated June 29, 2001, GE submitted a 10 CFR Part 21, "Reporting of Defects and Noncompliance," notification about the concern that stability reload licensing calculations using the generic delta critical power ratio (CPR) over initial minimum CPR (MCPR) versus oscillation magnitude Delta Critical Power Ratio Over Initial Minimum Critical Power Ratio Versus Oscillation Magnitude (DIVOM) curve could result in OPRM reactor trip system RPS trip setpoints which may not protect the MCPR safety limit.

By letter dated September 30, 2003 (ML032751632), the BWROG submitted a resolution for the Part 21 notification. The resolution required the licensee to use the plant-specific DIVOM curve, which is generated or confirmed for each reload fuel cycle consistent with the process described in "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications" (NEDO-32465A). The plant-specific curves will be reasonably conservative but not necessarily bounding for a particular fuel cycle. In conjunction with the 95/95 statistical approach of the licensing methodology, the plant-specific DIVOM curves will result in a high probability that the fuel cladding integrity safety limit will not be violated as a result of anticipated instability events.

TVA indicated they will utilize this plant-specific DIVOM calculation in the calculation of setpoints for the Option III system using the same process currently used for BFN Units 2 and 3.

#### 3.1 Specification 3.3.1.1 - RPS Instrumentation Actions

TVA proposed to add: (1) Function 2.f to both Notes in LCO 3.3.1.1 Required Action A.2 and in Condition B; and (2) new Conditions I and J together with Required Actions and Completion Times to the LCO Actions table.

The licensee provided the explanation for the TS changes as follows: (1) the new OPRM Upscale function is added for implementation of the approved BWROG Long-Term Stability

Solution Option III, (2) Required Action A.2 is not applicable for the new OPRM Upscale function because the OPRM provides signals to both RPS trip systems and Condition B is not applicable to the OPRM Upscale because loss of more than one of the required OPRM channels results in loss of OPRM scram capability and entry to Condition C, and (3) Condition I allows an alternate method to detect and suppress thermal-hydraulic instability and Condition J requires the plant to reduce Thermal Power to <25% reactor thermal power (RTP) within 4 hours if Condition J is not met.

The NRC staff has reviewed the proposed TS changes and found them acceptable because the implementation of the OPRM Upscale function is consistent with the NRC-approved methodology NEDC-32410P-A.

### 3.2 Specification 3.3.1.1 - RPS Instrumentation Surveillance Requirements (SR)

TVA proposed to add a new Surveillance, SR 3.3.1.1.17 to the SR table. The new SR ensures that scrams initiated from the OPRM Upscale trip function are not inadvertently bypassed when the Average Power Range Monitor (APRM) Simulated Thermal Power (STP) is greater than or equal to 25 percent and recirculation flow is less than 60 percent rated flow. SR 3.3.1.1.18 of NEDC-23410P-A, Supplement 1 verifies that the OPRM is not bypassed when APRM STP is greater than or equal to 30 percent licensed thermal power. The proposed value of 25 percent for the equivalent surveillance (SR 3.3.1.1.17) is more conservative, therefore, is acceptable. The SR will be performed on a 24-month surveillance frequency and is consistent with NEDC-32410P-A, Supplement 1, and is, therefore, acceptable.

### 3.3 Specification 3.3.1.1 - RPS Instrumentation Table 3.3.1.1-1

The licensee proposed to add a new APRM Function 2.f, the OPRM Upscale Function, together with Applicable Modes or other Specified Conditions, Required Channels Per Trip System, Conditions Referenced from Required Action D.1, Surveillance Requirements, and Allowable Value to Table 3.3.1.1-1.

The licensee stated that the OPRM trip was placed in Section 2 of Table 3.3.1.1-1 because the hardware needed to implement the OPRM Upscale Function 2.f is housed in the same chassis as the APRM trip functions and the OPRM Upscale trip is considered a subfunction of the APRM system. The OPRM Upscale Function is required only when the plant is operating at power greater than or equal to 25 percent RTP.

The NRC staff has reviewed the proposed changes and found them acceptable because the change is consistent with the approved methodology NEDC-32410P-A, Supplement 1.

### 3.4 Specification 3.4.1- Recirculation Loops Operating LCO 3.4.1

The licensee proposed to delete the restrictions related to thermal-hydraulic stability regions.

The NRC staff has reviewed the proposed changes and found them acceptable because these restrictions were added to the TS as part of Interim Corrective Actions (ICAs) while the BWROG worked with the NRC to develop a long-term resolution to stability concern. With the OPRM Upscale Function enabled, the long-term stability solution will be fully implemented, the ICAs will no longer be required, and, therefore, the restrictions can be removed.

### 3.5 Specification 3.4.1 - Recirculation Loops Operating LCO 3.4.1 Actions

The licensee proposed to delete: (1) Condition A and Condition B, together with the associated Required Actions and Completion Times in the Action table; and (2) Condition E, together with its associated Required Actions and Completion times. Conditions C and D are relabeled Conditions A and B, respectively.

The NRC staff has reviewed the changes and found them acceptable because: (1) previous Conditions A and B are exclusively related to stability ICAs that are no longer needed with the OPRM Upscale Function enabled, (2) relabeled A and B (previous Conditions C and D) were edited for clarity and consistency with the Units 2 and 3 TS, and (3) the deletion of Condition E and consolidation of the action for no recirculation loops operating for both MODES 1 and 2 in Condition B are administrative in nature.

### 3.6 Specification 3.4.1 - Recirculation Loops Operating LCO 3.4.1 Surveillance Requirements

The licensee proposed to delete: (1) SR 3.4.1.2 to verify the reactor is outside of Region I and II of Figure 3.4.1-1, and (2) Figure 3.4.1-1, Thermal Power Versus Core Flow Stability Regions.

The NRC staff reviewed the proposed changes and found them acceptable because the deletion of SR 3.4.1.2 and Figure 3.4.1-1 is exclusively related to stability ICAs that are no longer needed with the OPRM Upscale Function enabled.

The NRC staff concludes that the above described TS changes, involving the implementation of the BWROG long-term stability solution Option III, and provisions for enabling the OPRM Upscale function in the APRM, are acceptable because the proposed TS changes are in accordance with NEDC-32410P-A and NEDC-32410P-A, Supplement 1.

The NRC staff does not have any objections to the proposed changes to the TS Bases.

## 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Alabama 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 23962). 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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: N. Carte  
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Date: December 29, 2006

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## **BROWNS FERRY NUCLEAR PLANT**

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