

April 4, 2003

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

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3, REGARDING  
DELETION OF PRESSURE REGULATOR DOWNSCALE FAILURE AS AN  
OPERATIONAL TRANSIENT (TAC NOS. MB5945, MB5946, AND MB5947)

Dear Mr. Scalice:

The Commission has issued the enclosed Amendment Nos. 244, 281, and 239 to Facility Operating Licenses Nos. DPR-33, DPR-52 and DPR-68 for the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, respectively. These amendments consist of changes to your Updated Final safety Analysis report (UFSAR) and are in response to your application dated August 1, 2002.

We have concluded our review to eliminate consideration of a pressure regulator downscale failure as an abnormal operational transient because of the recent upgrade of the main turbine electrohydraulic control (EHC) system on BFN Units 2 and 3. The changes are also applicable to Unit 1, which is currently defueled, based on your commitment to upgrade the Unit 1 EHC system to a digital fault-tolerant design similar to that installed on Units 2 and 3 prior to returning Unit 1 to power operation.

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/*

Kahtan N. Jabbour, Senior Project Manager, Section 2  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260 and 50-296

Enclosures: 1. Amendment No. 244 to  
License No. DPR-33  
2. Amendment No. 281 to  
License No. DPR-52  
3. Amendment No. 239 to  
License No. DPR-68  
4. Safety Evaluation

cc w/enclosures: See next page

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We have concluded our review to eliminate consideration of a pressure regulator downscale failure as an abnormal operational transient because of the recent upgrade of the main turbine electrohydraulic control (EHC) system on BFN Units 2 and 3. The changes are also applicable to Unit 1, which is currently defueled, based on your commitment to upgrade the Unit 1 EHC system to a digital fault-tolerant design similar to that installed on Units 2 and 3 prior to returning Unit 1 to power operation.

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BROWNS FERRY AMENDMENT UNIT 1, 2, AND 3 DATED: April 4, 2003

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TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-259

BROWNS FERRY NUCLEAR PLANT UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 244  
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 August 1, 2002, 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, changes to the Updated Safety Analysis report (UFSAR) to reflect the modification of Browns Ferry Nuclear Plant, Units 1, 2, and 3, design and licensing basis as described in Section 14.5.2.8 of the UFSAR, to eliminate consideration of the pressure regulator downscale failure as an abnormal operational transient as set forth in the application for amendments dated August 1, 2002, are authorized. The licensee shall submit the revised description authorized by these amendments with the next update of the UFSAR.

Prior to returning Browns Ferry Unit 1 to power operation, the main turbine electrohydraulic control system will be upgraded to a digital fault-tolerant design similar to that installed on Units 2 and 3.

3. These license amendments are effective as of the date of issuance and shall be implemented as specified in 2 above.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA by B. Mozafari Acting for/*

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

Date of Issuance: April 4, 2003

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-260

BROWNS FERRY NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 281  
License No. DPR-52

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Tennessee Valley Authority (the licensee) dated August 1, 2002, 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, changes to the Updated Safety Analysis report (UFSAR) to reflect the modification of Browns Ferry Nuclear Plant, Units 1, 2, and 3, design and licensing basis as described in Section 14.5.2.8 of the UFSAR, to eliminate consideration of the pressure regulator downscale failure as an abnormal operational transient as set forth in the application for amendments dated August 1, 2002, are authorized. The licensee shall submit the revised description authorized by these amendments with the next update of the UFSAR
3. These license amendments are effective as of the date of issuance and shall be implemented as specified in 2 above.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA by B. Mozafari Acting for/*

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

Date of Issuance: April 4, 2003

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-296

BROWNS FERRY NUCLEAR PLANT, UNIT 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 239  
License No. DPR-68

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Tennessee Valley Authority (the licensee) dated August 1, 2002, 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, changes to the Updated Safety Analysis report (UFSAR) to reflect the modification of Browns Ferry Nuclear Plant, Units 1, 2, and 3, design and licensing basis as described in Section 14.5.2.8 of the UFSAR, to eliminate consideration of the pressure regulator downscale failure as an abnormal operational transient as set forth in the application for amendments dated August 1, 2002, are authorized. The licensee shall submit the revised description authorized by these amendments with the next update of the UFSAR
3. These license amendments are effective as of the date of issuance and shall be implemented as specified in 2 above.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA by B. Mozafari Acting for/*

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

Date of Issuance: April 4, 2003

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 244 TO FACILITY OPERATING LICENSE NO. DPR-33  
AMENDMENT NO. 281 TO FACILITY OPERATING LICENSE NO. DPR-52  
AMENDMENT NO. 239 TO FACILITY OPERATING LICENSE NO. DPR-68  
TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3  
DOCKET NOS. 50-259, 50-260, AND 50-296

## 1.0 INTRODUCTION

By letter dated August 1, 2002, the Tennessee Valley Authority (TVA or the licensee) submitted a request for changes to the Updated Final safety Analysis Report (UFSAR) for Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3.

Specifically, TVA requested approval to change the Browns Ferry Nuclear design and licensing basis as described in Section 14.5.2.8 of the UFSAR to eliminate consideration of a Pressure Regulator Downscale Failure (PRDF) event as an Abnormal Operational Transient (AOT). TVA stated that prior to returning Browns Ferry Unit 1 to power operation, the main turbine electrohydraulic control (EHC) system will be upgraded to a digital fault-tolerant design similar to that installed on Units 2 and 3.

## 2.0 EVALUATION

### 2.1 Background

TVA is requesting a change to the licensing basis to resolve a discrepancy that currently exists between the UFSAR and the bounding UFSAR's Chapter 14 transient analyses that are performed for Browns Ferry. The discrepancy was identified during a review of General Electric (GE) Services Instruction Letter (SIL) 614, Revision 0, "Backup Pressure Regulator" (Ref. 1) and Revision 1 to this SIL (Ref. 2). In SIL 614, GE confirmed that the PRDF transients initiated from full power are bounded by other transients (such as the turbine/generator trip AOTs), which is consistent with Section 4.5.2.8 of Browns Ferry's UFSAR. However, the SIL goes on to indicate that PRDF events from reduced power operation may not be bounded by other transients. Browns Ferry has initiated corrective action to resolve this discrepancy.

Subsequently, TVA implemented a major main turbine control system design change on Units 2 and 3 to replace the originally installed analog-based EHC system with an upgraded fault-tolerant digital EHC system. This modification was made to improve overall plant reliability

and address equipment obsolescence issues related to the analog EHC system. A primary attribute of the upgraded EHC system is its highly fault-tolerant design, which provides a technical basis for justifying the elimination of the PRDF event as an AOT. Therefore, to resolve the UFSAR discrepancy cited in the TVA's corrective action document, the licensee requested a license amendment to modify the UFSAR to remove the PRDF event from consideration as an AOT.

The changes are also applicable to BFN Unit 1, which is currently defueled, based on TVA's commitment to upgrade the Unit 1 EHC system to a digital fault-tolerant design similar to that installed on Units 2 and 3, prior to returning Unit 1 to power operation.

## 2.2 Description of the Original and Upgraded EHC Systems

TVA provided the following descriptions of the original and upgraded EHC systems.

### 2.2.a Description of the original EHC system

The previous turbine control EHC system consisted of two independent pressure sensing loops connected to the turbine steam supply header and the associated separate pressure setpoint controllers. These independent controllers each generated a steam flow demand with a small pressure bias difference. The two demand signals selected the higher of the two demand signals to control the turbine control valves and main turbine bypass valves. This system design ensured that for the majority of possible EHC control system failures, the control system responded by opening the turbine valves. This system design response avoided closing turbine valves, which reduced the likelihood of steam system transients that result in significant nuclear steam system pressure increases. Only limited portions of the original EHC system could fail in such a manner as to demand closure of the turbine control valves.

However, with one of the individual pressure controllers out-of-service, commonly referred to as operation with one pressure regulator out-of-service or operation without a backup regulator, failure modes that could result in a PRDF event are increased. Avoidance of this mode of operation was the subject of GE SIL 614.

### 2.2.b Description of the upgraded EHC system

An upgraded EHC system was installed on Units 2 and 3 during their most recent refueling outages. The upgraded EHC system is a micro-processor based control system, which handles both the turbine trip and control functions, as well as primary system pressure regulation [the upgraded EHC system was installed in accordance with Title 10, Code of Federal Regulations (10 CFR), Section 50.59]. A separate similar control system serves the turbine bypass valves. The modified turbine control system is a highly fault-tolerant design such that a failure of an individual component cannot cause more than one turbine control valve to close unless it is associated with a turbine trip.

Fault-tolerant design is accomplished by the employment of three micro-processors which utilize 2-out-of-3 logic to validate inputs (such as reactor

pressure) and outputs (such as control valve position demand). An additional pressure control mode was added using four reactor pressure instrument channels as inputs to the pressure regulation function. The pressure control mode of the previous EHC system using two steam line header pressure instrument channels is also included. With the large number of pressure instrument channels provided, the need to operate with only one pressure input (operation without a backup pressure regulator) is virtually eliminated when compared to the original EHC design.

### 2.3 Regulatory Evaluation

Section 50.34 of 10 CFR, "Contents of applications; technical information," establishes the requirements for the analysis and evaluation of the design and performance of structures, systems, and components to address normal operation and transient conditions anticipated during the life of the facility. Appendix A to Part 50 defines anticipated operational occurrences as those conditions of normal operation which are expected to occur one or more times during the life of the nuclear power unit.

An upgraded main turbine EHC system, which is fault-tolerant design, was installed on Units 2 and 3 during recent refueling outages. With this modification, TVA has determined that the PRDF event is no longer an event that will be expected to occur during the life of the plant, Therefore, it should be eliminated from the UFSAR listing of required transient analyses.

By letter dated March 29, 2000 (Ref. 3), the NRC staff approved a similar request for the BWR-6 boiling-water reactors in response to a request from GE dated October 22, 1999. The request was to remove the PRDF event as an AOT based on the high-reliability of the BWR-6 EHC system. Similarly, the upgraded fault-tolerant EHC system at Browns Ferry is a highly reliable system. Therefore, the change is acceptable.

### 2.4 Staff Evaluation

The fault-tolerant design of the upgraded EHC system would greatly reduce the likelihood that, during normal plant operation with all EHC components in service, a single component failure would cause more than one turbine control valve to close without an accompanying turbine trip, precluding a reactor system overpressure condition. Also, the availability of the larger number of pressure sensing instrument channels in the upgraded EHC system greatly reduces the likelihood of operating with the pressure regulation function of the EHC in a degraded mode. The reliability of the upgraded EHC system is such that an EHC system failure that results in the simultaneous closure of all turbine control valves is not an anticipated failure and, hence, the PRDF transient no longer merits evaluation as an anticipated operational transient.

The changes are also applicable to BFN Unit 1, which is currently defueled, based on your commitment to upgrade the Unit 1 EHC control system to a digital fault-tolerant design similar to that installed on Units 2 and 3, prior to returning Unit 1 to power operation.

Based on its review, the NRC staff finds that the deletion of the pressure regulator downscale transient event as AOT from the Browns Ferry UFSAR is acceptable.

### 3.0 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.

### 4.0 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 amendments involve 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 amendments involve no significant hazards consideration, and there has been no public comment on such finding (67 FR 63697). Accordingly, the amendments meet 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.

### 5.0 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.

### 6.0 REFERENCES

1. GE Nuclear Energy Service Instruction Letter (SIL) No. 614, "Backup Pressure Regulator," Revision 0, November 5, 1997.
2. GE Nuclear Energy Service Instruction Letter (SIL) No. 614, "Backup Pressure Regulator," Revision 1, March 15, 1999.
3. Letter from S. A. Richards (NRC) to G. A. Watford (GE) dated March 29, 2000, Amendment 26 to GE Nuclear energy Licensing Topical Report NEDE-24011-P-A (GESTAR II) - Clarifying Classification BWR-6 Pressure Regulator Failure Downscale Event (TAC No. MA6481).

Principal Contributors: Tanya Ford, NRR  
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Date: April 4, 2003

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**BROWNS FERRY NUCLEAR PLANT**

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