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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 216 TO FACILITY OPERATING LICENSE NO. DPR-33

AMENDMENT NO. 232 TO FACILITY OPERATING LICENSE NO. DPR-52

AMENDMENT NO. 190 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 March 31, 1994, the Tennessee Valley Authority (the licensee) requested amendments to the operating licenses for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3. These amendments consist of revisions to the BFN Unit 1, 2, and 3 Technical Specifications (TS). The licensee proposed to revise the BFN Unit 1 and 3 TS to incorporate changes to the extended load line limit (ELLL) and rod block monitor (RBM) operability requirements which were previously approved for BFN Unit 2. The licensee also proposed to delete a specific value for reactor recirculation flow rate, and to relocate rod block equations to the core operating limits report (COLR) for all three BFN units. The NRC staff evaluation of these revisions is given below.

2.0 EVALUATION

In its submittal of March 31, 1994, the licensee separated the components of its request into five sections, designated "A" through "E." This evaluation addresses each of these items in turn.

2.1 Part A: Extended Load Line Limit (BFN Units 1 and 3)

For BFN Units 1 and 3, the licensee has proposed to revise equations used for the flow-biased average power range monitor (APRM) flux reactor scram trip setpoint and the APRM rod block trip setting. Using the revised equations extends the allowable reactor operating envelope into the extended load line limit (ELLL) region. Similar changes have been previously approved for BFN Unit 2 on December 18, 1990. The changes proposed to support ELLL operation are given below.

To support ELLL operation, Limiting Safety System Setting (LSSS) 2.1.A.1.a will be revised from:

$$S \leq 0.66W + 54\% \quad \text{to:} \quad S \leq 0.58W + 62\%$$

where: S = flow biased APRM Flux Scram Trip setting, and
W = reactor core flow rate, % of rated.

ENCLOSURE 4

Figure 2.1-2, "APRM Flow Bias Scram Vs. Reactor Core Flow," will also be revised consistent with the change in the LSSS equation.

The licensee also proposes editorial changes consistent with the revised TS.

ELLL operation has been evaluated using the General Electric Standard Application for Reactor Fuel, or GESTAR-II, which is an NRC-approved methodology. GESTAR-II sets forth the requirements to demonstrate acceptable reactor operation within the ELLL. To support ELLL operation for BFN Unit 2, an ELLL analysis was performed which demonstrated design limits would not be exceeded for limiting anticipated operational occurences and loss of coolant accidents. The licensee has subsequently determined that this analysis is also applicable to BFN Units 1 and 3. The licensee states that BFN Units 1 and 3 reload analyses will be performed using the GESTAR-II methodology.

The proposed changes provide adequate assurance that reactor fuel design limits will be preserved for the appropriate range of accident conditions, consistent with methods accepted by the NRC staff. Therefore, the changes are acceptable.

2.2 Part B: Rod Block Monitor Operability Requirements (BFN Units 1 and 3)

The licensee proposes to revise rod block monitor (RBM) operability requirements to ensure two RBM channels are operable for low thermal margin conditions, and one RBM channel is operable for higher thermal margin conditions. This revision provides additional margin which permit implementation of a higher flow-biased RBM setpoint, improving operational flexibility. As discussed in Section 2.5 below, the flow-biased RBM setpoint will be located in the COLR. The licensee also proposes new and revised definitions for terms used to quantify thermal margin. These changes are similar to changes previously approved for BFN Unit 2 on October 21, 1993. The changes proposed by the licensee are discussed below.

The licensee has proposed a new definition 1.U.5, Core Maximum Fraction of Critical Power (CMFCP). This parameter is the maximum value of the flow-corrected critical power ratio (CPR), as defined by technical specifications, divided by the actual CPR for all fuel assemblies in the core. This definition of CMFCP is currently used in BFN procedures and is consistent with standard boiling water reactor (BWR) vocabulary. Application of the definition, as discussed below, provides an appropriate description of reactor thermal margin. Therefore, the proposed definition is acceptable.

The existing BFN Unit 1 and 3 TS also include definition 1.U.3, Core Maximum Fraction of Limiting Power Density (CMFLPD). This parameter is defined as the ratio of the maximum fuel rod power density for a given fuel type to the limiting fuel rod power density for that fuel type.

CMFLPD and CMFCP are used to quantify core thermal margin. During normal operations, these values will be less than one, which indicates the core has margin to thermal operating limits. The closer the value of CMFLPD or CMFCP to one, the lower the core thermal margin. CMFLPD and CMFCP are calculated by the plant computer based upon current core thermal-hydraulic and power

distribution characteristics, and are available to the plant operators. If the plant computer is unavailable, these parameters can be calculated off-line in accordance with existing plant procedures.

The licensee also proposes to add a new definition 1.00 describing a limiting control rod pattern. A limiting control rod pattern is an arrangement of control rods which results in the core operating at a thermal limit, such as for minimum CPR or linear heat generation rate. The proposed definition is consistent with standard BWR usage and is acceptable.

The licensee proposes revisions to TS 3.3.B.5 and 4.3.B.5 which apply these requirements for low thermal margin conditions. These revisions ensure thermal limits are not exceeded for limiting rod withdrawal events initiated from low thermal margin conditions. Therefore, the proposed changes are acceptable.

An additional change is proposed for TS 4.5.K.1 regarding surveillance requirements for minimum critical power ratio (MCPR). This change reflects the new definition of limiting control rod pattern, and is acceptable.

2.3 Part C: Miscellaneous Editorial Changes (BFN Units 1, 2, and 3)

The licensee proposes several miscellaneous editorial changes to the TS and the Bases. The submittal of March 31, 1994 describes a total of twelve items. Items 1 through 4, 7, and 9 through 11 pertain to revised Bases discussion. Items 5, 6, 8, and 12 affect TS requirements.

Item 1 adds wording to Bases 2.1.A.1 that clarifies the usage of the APRM flow-biased high flux scram trip setting for the "RUN" mode for power increase transients. The change appropriately describes this function and is acceptable.

Item 2 is an editorial change to add the word "scram" to Bases 2.1.A.1. This change corrects the previous wording, and is acceptable.

Item 3 is an editorial change to revise wording and punctuation in Bases 2.1.A.3. The meaning of this discussion is unchanged. Therefore, the revision is acceptable.

Item 4 revises Bases 2.1.G & H to rephrase the discussion of the scram on main steam isolation valve closure. The change appropriately describes this function and is acceptable.

Item 5 revises Note 7.a to Table 3.2.C to change the word "and" to "or" in the BFN Unit 1 and 3 TS. This change is similar to a change previously approved for BFN Unit 2 on July 2, 1992, and clarifies the operation of the RBM system. This change is acceptable.

Item 6 pertains to deletion of notes in the BFN Unit 2 TS which were relevant only during a previous operating cycle. These notes were previously deleted by an amendment dated December 7, 1994.

Item 7 proposed changes to the BFN Unit 2 TS Bases. These changes were incorporated into Amendment 229, which was issued on December 7, 1994.

Items 8 through 12 all refer to changing words in the TS and Bases from lower case to upper case, or vice versa, as appropriate to reflect the usage of upper case to designate terms defined in TS section 1, "Definitions." The changes appropriately reflect this standard usage, and is acceptable.

2.4 Part D: Deletion of Specific Value for Rated Loop Recirculation Flow Rate (BFN Units 1, 2, and 3)

The licensee proposes to delete a specific value for the rated loop recirculation flow rate from TS 2.1.A.1.a. This TS provides the APRM flow-biased flux scram trip setting, which is based on this rated flow value. This flow rate is the amount of recirculation system drive flow required to achieve 100% total core flow. The value given in the current TS was accurate early in the operating life of the facilities. However, as components have aged, the amount of loop flow required to yield 100% core flow has increased. The licensee believes that retaining an obsolescent value in the TS is unnecessary.

In response to questions from the reviewer, the licensee demonstrated why using the actual loop flow value measured each fuel cycle is more conservative than using the value specified in the TS. For BFN Unit 2, the APRM flow-biased scram setpoint is calculated by the equation:

$$S \leq 0.58W + 62\%$$

where: S = flow-biased APRM Flux Scram Trip setting, and
W = reactor core flow rate, % of rated.

Note that Section 2.1 above discusses implementing this same setpoint equation for BFN Units 1 and 3. Assuming a loop flow rate is 20×10^6 lbs/hr and the loop flow rate to yield 100% core flow of 34.2×10^6 lbs/hr (as given in the current TS), the flow-biased APRM flux scram trip setpoint would be less than or equal to 95.92% power. If one uses a loop flow rate for 100% core flow of 36.36×10^6 lbs/hr (as measured for BFN Unit 2 Cycle 8), the setpoint would be 93.90% power. Since a lower setpoint is more restrictive, using the cycle-specific flow rate is conservative. Therefore, the proposed change is acceptable.

2.5 Part E: Relocate APRM Rod Block and RBM Setpoint Equations to COLR (BFN Units 1, 2, and 3)

The licensee proposes to relocate the APRM rod block and RBM setpoint equations to the Core Operating Limits Report. The COLR was incorporated in the BFN Unit 1, 2, and 3 TS consistent with the guidance of Generic Letter (GL) 88-16 in amendments dated May 20, 1993.

To incorporate fuel cycle-specific parameters into the COLR, GL 88-16 requires that the parameters be established using an NRC-approved methodology consistent with all applicable limits of the plant safety analysis as

described by the Final Safety Analysis Report (FSAR) for the facility. References to the cycle-specific parameters in the TS are modified to refer to the COLR, which is submitted to the NRC for each fuel cycle.

To transfer these equations from the TS to the COLR, several TS changes are required. The changes proposed by the licensee reflect deletion of the equations from the TS, and provide proper reference to the COLR as the source of the equations.

The licensee states that the APRM rod block and RBM setpoint equations are derived from fuel cycle-specific calculations based on NRC-approved methodology which preserves appropriate design limits. These equations are already part of the COLR for the current BFN Unit 2 operating cycle (see TVA letter dated October 31, 1994), and will be included in the COLR for future operating cycles of BFN Units 1 and 3. Transferring these equations from the TS to the COLR is consistent with the guidance of GL 88-16, and 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 amendments change 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 the surveillance requirements. 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 (59 FR 49437). The amendments also change recordkeeping or reporting requirements. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and (10). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

5.0 CONCLUSION

The Commission has concluded, based upon 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, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Dated: February 24, 1995