

*a/29/78*

Docket No. 50-259

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Mr. N. B. Hughes, Manager of Power  
Tennessee Valley Authority  
830 Power Building  
Chattanooga, Tennessee 37401

Dear Mr. Hughes:

The Commission has issued the enclosed Amendment No. <sup>43</sup> to Facility License No. DPR-33 for the Browns Ferry Nuclear Plant, Unit No. 1. On September 19, 1978, we issued Amendment No. 41 to Facility License No. DPR-33 which permitted you to operate Browns Ferry Unit No. 1 with one recirculation loop isolated with the restriction that power level be limited to 50% of licensed power. This amendment, which is in response to your request of September 28, 1978, raises the maximum allowable power level to 82%. With your concurrence, we have also amended the Technical Specifications to require that the suction valve and recirculation pump in the idle recirculation loop be electrically disarmed while operating with one recirculation loop. This amendment authorizes you to operate Browns Ferry Unit 1 with one recirculation loop isolated for the remainder of the current fuel cycle.

Copies of the Safety Evaluation and Notice of Issuance are also enclosed.

Sincerely,

Thomas A. Ippolito, Chief  
Operating Reactors Branch #3  
Division of Operating Reactors

Enclosures:

- 1. Amendment No. <sup>43</sup> to DPR-33
- 2. Safety Evaluation
- 3. Notice

cc w/encl:  
See next page

BScharf(15)  
JMcGough  
JSaltzman  
BHarless  
CMiles  
RDiggs  
RWoods  
TERA  
JRBuchanan  
DRoss  
DEisenhut

*Const*  
*PH*

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SURNAME >	SMSheppard:1b	RClark	<i>[Signature]</i>	Tippolito	PCheck	
DATE >	9/29/78	9/29/78	9/29/78	9/29/78	10/2/78	

Tennessee Valley Authority

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U. S. Environmental Protection  
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Region IV Office  
ATTN: EIS Coordinator  
345 Courtland Street  
Atlanta, Georgia 30308



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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-259

BROWNS FERRY NUCLEAR PLANT, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 43  
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 September 28, 1978, 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 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. 43, 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 the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

  
Thomas A. Appolito, Chief  
Operating Reactors Branch #3  
Division of Operating Reactors

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: September 29, 1978

ATTACHMENT TO LICENSE AMENDMENT NO. 43

FACILITY OPERATING LICENSE NO. DPR-33

DOCKET NO. 50-259

Revise Appendix A as follows:

1. Remove the following pages and replace with identically numbered pages:  
181/182
2. Marginal lines indicate revised area. The overleaf page is provided for convenience.

**3.6.C Coolant Leakage**

3. If the condition in 1 or 2 above cannot be met, an orderly shutdown shall be initiated and the reactor shall be shutdown in the Cold Condition within 24 hours.

**D. Safety and Relief Valves**

1. When more than one valve, safety or relief, is known to be failed, an orderly shutdown shall be initiated and the reactor depressurized to less than 105 psig within 24 hours.

**E. Jet Pumps**

1. Whenever the reactor is in the startup or run modes, all jet pumps shall be operable. If it is determined that a jet pump is inoperable, or if two or more jet pump flow instrument failures occur and cannot be corrected within 12 hours, an orderly shutdown shall be initiated and the reactor shall be shutdown in the Cold Condition within 24 hours.

**4.6.C Coolant Leakage****D. Safety and Relief Valves**

1. At least one safety valve and approximately one-half of all relief valves shall be bench-checked or replaced with a bench-checked valve each operating cycle. All 13 valves (2 safety and 11 relief) will have been checked or replaced upon the completion of every second cycle.
2. Once during each operating cycle, each relief valve shall be manually opened until thermocouples downstream of the valve indicate steam is flowing from the valve.
3. The integrity of the relief/safety valve bellows shall be continuously monitored.
4. At least one relief valve shall be disassembled and inspected each operating cycle.

**E. Jet Pumps**

1. Whenever there is recirculation flow with the reactor in the startup or run modes with both recirculation pumps running, jet pump operability shall be checked daily by verifying that the following conditions do not occur simultaneously:
  - a. The two recirculation loops have a flow imbalance of 15% or more when the pumps are operated at the same speed.

4.6.E Jet Pumps3.6.F Jet Pump Flow Mismatch

1. When both recirculation pumps are in steady state operation, the speed of the faster pump shall be maintained within 122% the speed of the slower pump when core power is 80% or more of rated power or 135% the speed of the slower pump when core power is below 80% of rated power.

2. If specification 3.6.F.1 cannot be met, one recirculation pump shall be tripped.

The reactor may be started and operated with one recirculation loop out of service for the duration of cycle 2 provided the MAPLHGR limits in Tables 3.5I-1, -2, -3 & -4 are reduced by 30% for 7x7 fuel and 15% for 8x8 fuel, power level is limited to a maximum of 82% of licensed power, the suction valve in the idle loop is closed and the pump and suction valve are electrically disarmed.

4. Following one pump operation, the discharge valve of the low speed pump may not be opened unless the speed of the faster pump is less than 50% of its rated speed.
5. Steady state operation with both recirculation pumps out of service for up to 12 hrs is permitted. During such interval restart of the recirculation pumps is permitted, provided the loop discharge temperature is within 75°F of the saturation temperature of the reactor vessel water as determined by dome pressure.

G. Structural Integrity

1. The structural integrity of the primary system shall be

4.6.E Jet Pumps

- b. The indicated value of core flow rate varies from the value derived from loop flow measurements by more than 10%.
- c. The diffuser to lower plenum differential pressure reading on an individual jet pump varies from the mean of all jet pump differential pressures by more than 10%.

2. Whenever there is recirculation flow with the reactor in the Startup or Run Mode and one recirculation pump is operating with the equalizer valve closed, the diffuser to lower plenum differential pressure shall be checked daily and the differential pressure of an individual jet pump in a loop shall not vary from the mean of all jet pump differential pressures in that loop by more than 10%.

F. Jet Pump Flow Mismatch

1. Recirculation pump speeds shall be checked and logged at least once per day.

G. Structural Integrity

1. Table 4.6.A together with supplementary notes, specifies the



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 43

FACILITY LICENSE NO. DPR-33

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT NO. 1

DOCKET NO. 50-259

Introduction

On September 19, 1978, we issued Amendment No. 41 to Facility Operating License No. DPR-33 which permitted TVA to operate Browns Ferry Unit No. 1 (BF-1) with one recirculation loop out of service for the remainder of the current fuel cycle (cycle 2) but with the restriction that power level be limited to a maximum of 50% of licensed power. Power was limited to 50% of full licensed power by the new Technical Specifications due to lack of an acceptable analysis of the locked pump rotor accident for one loop operation. Our SER issued with the Technical Specification changes gave the bases for acceptability of the 50% power limit. That SER also discussed the bases for a restriction that power could not exceed 68% of full licensed power until further information regarding the inadvertent pump startup transient analysis was provided.

Summary

We have reviewed the TVA submittal of September 28, 1978, requesting deletion of the above described power restrictions. We find it acceptable to remove both of the power restrictions on the bases discussed below, provided that the maximum power level not exceed 82% of full licensed power for the reasons discussed below.

Evaluation

One Pump Seizure Accident

TVA has submitted results of calculations for the pump seizure accident assuming one loop operation (submittal of September 28, 1978). These calculations utilized the standard, conservative, plant specific inputs that were used for the transients and accidents that were analyzed for the latest BF-1 reload (Amendment 35 issued January 10, 1978).

These calculations utilized the General Electric REDY code to model the transient behavior of the reactor core. No model changes were made to the code for this use. The code is currently used for reload transient analyses performed for BF-1 and other BWRs. Pump seizure was simulated in the same



acceptable manner as for previously performed pump seizure analyses with two pump operation (the method results in the pump stopping completely in less than one revolution). Appropriate input changes were made to reflect operation with one recirculation loop. Although a review is currently in progress concerning continued acceptability of the REDY code for analysis of pressurization transients, this transient is characterized as a loss-of-flow event. REDY code results are currently accepted for such analyses.

REDY results were input into the General Electric SCAT02 code which calculates thermal margin (Minimum Critical Power Ratio, MCPR). This code was not modified in any way for this purpose. SCAT02 is currently used and accepted for BF-1 and other plant transient analyses that are performed for reload submittals.

Two sets of initial conditions were analyzed (power-flow initial conditions equal to 75% power - 58% flow and 82% power - 56% flow). These conditions represent, respectively: (1) the maximum flow possible through the core (allowing for backflow through the idle jet pumps) due to one pump operation with power corresponding to that flow from the highest (105%) power-flow load line; and (2) an even higher power for the same one pump operation (core flow is 2% lower due to increased flow resistance in the core due to added voiding at the higher power). We find these assumed initial conditions acceptable since they conservatively bound the highest power operation possible under one loop operation conditions.

The analyses indicate that the following sequence of events occurs: the operating pump seizes and external recirculation loop flow goes very rapidly to zero; core flow continues due to momentum effects and buoyancy effects; as momentum is dissipated, core flow will decrease; as core flow decreases, voiding in the core will increase; increased voiding will reduce core thermal power due to the feedback effect from the negative void coefficient; and finally, the core will reach a new equilibrium power and flow determined by the natural re-circulation characteristics of the core, with no flow in the external recirculation loop (flow will be up through the core, driven by buoyant force as water is heated and boiled in the core, then down through the internal jet pumps, then repeat). Steam produced will continue to go out the main steam line to the turbine/condenser system, then back to the reactor through the feedwater system. Water level in the core will first increase due to the increased voiding, then will decrease as core power decreases and stored heat is removed, but the level fluctuations are not severe enough to trip (scram) the reactor on either high or low water level. Neutron flux decreases due to the void feedback so no high flux scram occurs. Pressure does not reach the high pressure scram point (in fact, pressure decreases) since no isolation occurs and steam continues flowing to the turbine while steam production decreases as power decreases. Thus, no reactor scram is anticipated from any signal.

During the above sequence of events, the MCPR does not go below the Safety Limit MCPR, which is set to insure lack of any significant fuel damage. Therefore, we conclude that no significant fuel damage will occur, and therefore the acceptance criteria is met for this accident (i.e., that releases remain below a small fraction of the requirements stated in 10 CFR Part 100).

On the basis of the above described plant specific analyses which have been provided, we conclude that the 50% power limit previously imposed on BF-1 for single loop operation for the remainder of the present cycle can be increased to 82% power, the maximum power level for which the consequences of the pump seizure accident have been demonstrated to be acceptable.

#### Inadvertent Cold Loop Startup Transient

TVA has closed the suction valve on the disabled loop and has locked out and tagged power to that valve and to the disabled loop's recirculation pump. In addition, TVA has stated that "the brushes have been lifted from the recirculation pump M-G set and will not be reinstated until the next refueling outage. Replacement of the brushes takes several hours and could not be performed without authorization." Therefore, we consider unplanned startup of the idle loop to be incredible during the remainder of the present cycle. Furthermore, the discharge valve (whose internal failure and partial closure caused the loop's shutdown) cannot be repaired until the unit is shut down at end-of-cycle. Therefore, planned loop startup will not occur during the remainder of the present cycle, and the attendant slight possibility of utilizing improper procedures during such a planned startup, and inadvertently introducing cold water suddenly into the primary system, will be avoided.

On the above stated bases we conclude that the occurrence of this transient is not credible during the remainder of the present cycle, and we find it acceptable to delete the 68% maximum power restriction for one loop operation stated in our previous SER.

#### Monitoring of Safety Margins for One Loop Operation

Our previous SER, issued with Amendment No. 41, stated the bases for acceptability of the BF-1 MAPLHGR limits that will be observed during the remainder of this cycle for one loop operation. Those limits conservatively account for the unavailability of one of the plants recirculation loops by assuming no credit for coastdown flow from the unavailable loop following a LOCA. We therefore conclude that operation with one loop out of service, with the reduced limits, does not result in any decrease in overall plant safety margins, i.e., that the reduced limits acceptably account for the reduction in plant equipment that is available.

The plant is required to monitor compliance with the MAPLHGR limits every 24 hours. The process computer prints out a quantity called MAPRAT, which is the ratio of the current (measured) MAPLHGR to the current MAPLHGR calculated limit. This is done every 2 hours for the 6 locations in the core that are closest to the limit. Values greater than 1.0 thus indicate a violation. The process computer has been programmed to assume the reduced limits that have been approved for one loop operation when calculating MAPRAT. We find the above described method of monitoring compliance with the MAPLHGR limits to be easy to monitor and acceptable.

We do not believe that overall plant safety margins have been decreased as stated in the first paragraph above. We note that we have previously approved operation of BF-1 at higher power levels with the same method and frequency of monitoring for compliance with the MAPLHGR limits. Since safety margins has not been degraded by operation with a single loop, we find the method of monitoring equally to be acceptable for one loop operation.

#### Environmental Consideration

We have determined that this amendment does not authorize a change in effluent types or total amounts nor an increase in power level authorized by the license and will not result in any significant environmental impact. Having made this determination, we have further concluded that this amendment involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement, negative declaration, or environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

#### Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability of consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Dated: September 29, 1978

DOCKET NO. 50-259

TENNESSEE VALLEY AUTHORITY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY  
OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 43 to Facility Operating License No. DPR-33 issued to Tennessee Valley Authority (the licensee), which revised the Technical Specifications for operation of the Browns Ferry Nuclear Plant, Unit No. 1 (the facility) located in Limestone County, Alabama. The amendment is effective as of the date of issuance.

On September 19, 1978, we issued Amendment No. 41 to the above license to permit operation at a maximum of 50% of licensed power level with one recirculation loop isolated. This amendment changes the Technical Specifications to raise the restriction on allowable power level to 82% while the facility is operating with one recirculation loop isolated.


The application for this amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated September 28, 1978, (2) Amendment No. 43 to License No. DPR-33, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. and at the Athens Public Library, South and Forrest, Athens, Alabama 35611. A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 29 day of September 1978.

FOR THE NUCLEAR REGULATORY COMMISSION

  
Thomas A. Ippolito, Chief  
Operating Reactors Branch #3  
Division of Operating Reactors