



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

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

SUPPORTING AMENDMENT NO. 154 TO FACILITY OPERATING LICENSE NO. DPR-33

AMENDMENT NO. 150 TO FACILITY OPERATING LICENSE NO. DPR-52

AMENDMENT NO. 125 TO FACILITY OPERATING LICENSE NO. DPR-68

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3

DOCKET NO. 50-259, 50-260 AND 50-296

1.0 INTRODUCTION

By letter dated April 20, 1988, the Tennessee Valley Authority (TVA or the licensee) requested an amendment to Appendix A of the Brown's Ferry Nuclear Plant (BFN) Units 1, 2 and 3 Technical Specifications (TS). The proposed amendment would modify the Standby Liquid Control System (SLCS) TS to allow the use of enriched sodium pentaborate. This includes modifying the limiting conditions for operation of TS Section 3.4.C to restore the cold shutdown requirement in terms of Boron-10 and to limit the concentration of the sodium pentaborate solution, thus limiting the saturation temperature. TS 3.4.D is added to incorporate an equivalency equation to ensure that the requirements for reduction of risk from Anticipated Transients Without Scram (ATWS) events of 10 CFR 50.62 are met.

Three new surveillance requirements are added providing for: (1) the calculation and recording of the quantity of Boron-10 in the SLC solution tank at least once per month, (2) the verification of Boron-10 enrichment following the addition of any Boron to the solution, and (3) the verification that the equivalency equation given in 3.4.D is satisfied.

Due to the lower required concentration of sodium pentaborate and its associated saturation temperature the requirement to monitor the solution temperature is deleted. In addition, Figure 3.4-1, "Sodium Pentaborate Solution Volume - Concentration Requirements" and Figure 3.4-2 "Sodium Pentaborate Solution Temperature Requirements" are deleted.

The final TS change would revise TS 3.4.A.1, SLCS operability requirements. The proposed change would replace the requirement that all operable control rods be fully inserted with a requirement that the reactivity limitations of TS 3.3.A.1 be satisfied.

## 2.0 EVALUATION

Paragraph (c)(4) of 10 CFR 50.62 states in part, "Each boiling water reactor must have a Standby Liquid Control System (SLCS) with a minimum flow capacity and boron content equivalent in control capacity to 86 gallons per minute of 13 weight percent sodium pentaborate solution." Two options for meeting this requirement are (1) increased flow rate by two pump operation or (2) the use of enriched boron. The licensee in its letter dated April 20, 1988 informed the staff of their intent to meet the above requirement by utilizing Boron-10 enrichment.

### 2.1 Equivalency with the ATWS Rule

The requirement of the ATWS rule in 10 CFR 50.62, paragraph (c)(4) is that the SLCS have a minimum flow capacity and boron content equivalent in control capacity to 86 gallons per minute of 13 weight percent sodium pentaborate solution. This requirement assumes the use of natural boron which contains 19.8 atom percent Boron-10. Boron-10 is the isotope of concern when determining the control capacity of the sodium pentaborate. Equivalency can be satisfied by comparing concentration, flow rate, and Boron-10 enrichment for the actual system with the ATWS rule. BFN will continue to check the solution concentration at least once a month and any time water or boron is added to the solution. The flow rate used in the equation will be determined once during each operating cycle as required by TS Section 4.4.A.2.b. A requirement is added to calculate and subsequently verify by analysis the Boron-10 enrichment following each addition of boron to the solution tank.

### 2.2 Standby Liquid Control System Requirements for Cold Shutdown

Currently, the Browns Ferry Nuclear Plant Final Safety Analysis Report (FSAR) specifies 600 ppm natural boron as the average concentration in the reactor coolant to provide the required shutdown margin. This concentration will not be adequate to meet the SLCS shutdown margin requirements for future cycles beginning with cycle 6 of Unit 2. TVA Reactor Fuel and Analysis staff, along with General Electric, has confirmed that 660ppm natural boron will satisfy the SLCS shutdown requirement for projected future cycles. This 660 ppm natural boron concentration is increased by 25 percent to 825 ppm natural boron to allow for imperfect mixing, leakage, and piping connected to the reactor.

Using this 825 ppm natural boron and the volume of reactor coolant in cold shutdown condition, the amount of natural boron required can be determined. Then using 19.8 percent, the atom percent of boron-10 in natural boron, the amount of Boron-10 required for cold shutdown can be determined. This calculation shows that 179.4 pounds of Boron-10 is required to achieve cold shutdown. Therefore, at least 180 pounds of Boron-10 must be stored in the SLCS solution tank at all times when the SLCS is required to be operable.

### 2.3 Maximum Allowed Sodium Pentaborate Concentration Without Heat Tracing

TVA Drawing 47W225-63 gives a minimum normal temperature of 60°F and a minimum abnormal temperature of 50°F for the SLC tank area on elevation 639.0 of the Reactor Building. The saturation temperature of a 9.2 percent sodium pentaborate solution is 40°F. Thus, a 10°F margin is maintained at all times.

The temperature monitoring requirements have been deleted from the technical specifications since the new upper limit on the solution concentration has been set at 9.2 weight percent sodium pentaborate. At this concentration, the saturation temperature is 10°F below the minimum abnormal temperature for that area of the building. Therefore, TS surveillance of the solution temperature is no longer necessary. However, a temperature alarm at a preset low temperature will remain in operation. Its alarm setpoint will be changed to 50°F plus an allowance for drift.

The current TS bases state that should evaporation occur the low level alarm will annunciate before the temperature-concentration requirements are exceeded. The revised bases have deleted this statement since (1) the volume and concentration requirements have changed, (2) the system heat tracing will no longer be used for normal operation, thereby reducing any evaporative losses, and (3) significant evaporation has not occurred in the past.

The low level alarm setpoint has been lowered because of the reduced volume of solution required. The high level alarm setpoint has also been lowered which will enhance its primary safety function of warning the operator before the tank can overflow if water is being added accidentally.

### 2.4 Solution Surveillance

The tank level will be observed daily. The sodium pentaborate concentration will be analyzed with the same frequency as at present. In addition, the Boron-10 enrichment will be determined by calculation within 24 hours of an addition of boron and once per 18 months. The 24-hour interval is based on engineering judgment considering the capability to perform the surveillance. Calculations will be confirmed by analysis within 30 days. BFN intends to have the capability to perform the enrichment analysis on site within seven days of the addition of boron. A 30-day period has been proposed should a sample need to be sent off site because of test equipment inoperability. Since enrichment is not expected to vary over time except by addition of boron with a different Boron-10 enrichment, this is an adequate surveillance interval. The possibility of a loss of enrichment control will be precluded by procurement from a certified vendor, segregated storage, random sampling prior to use by an offsite laboratory, the removal from the site of all remaining natural boron, and the handling and addition of boron only by chemistry personnel.

## 2.5 Normal System Availability

The bases for specification 3.4.A.1 states "if no more than one operable control rod is withdrawn, the basic shutdown reactivity for the core is satisfied and the SLCS is not required." This comes from TS 3.3.A.1, which requires a sufficient number of control rods operable to make the core subcritical in the most reactive condition with the strongest control rod fully withdrawn and all other operable rods fully inserted. Meeting TS 3.3.A.1 will assure a sufficient reactivity margin is available to shutdown the reactor with control rods. Revising TS 3.4.A.1 to require the SLCS to be operable when there is fuel in the reactor vessel and the reactor is not shutdown, with TS 3.3.A.1 satisfied, will provide consistency among the TS. This change is also similar to Standard TS (NUREG 1202) which allows the control rods to be withdrawn under limited conditions while not requiring the SLCS to be operable.

The surveillance requirements are being revised to eliminate ambiguity by reordering the sentences in TS 4.4.A.2.b. This change is included for clarification only and does not result from any change in the testing procedure.

## 2.6 Shutdown Requirement

Technical Specification 3.4.E is revised and renumbered to allow eight hours to make at least one of the subsystems operable or shut down the reactor within the following twelve hours. With the SLCS unable to perform its function, continued operation is only justifiable for a short time period. The eight hour timeframe is based on engineering judgment considering the low probability of the requirement to use the SLCS. If at least one subsystem cannot be made operable, the reactor must be placed in hot shutdown within the following twelve hours. The twelve hour timeframe to reach hot shutdown is based on engineering judgment considering the capability to reach the specified condition. Insertion of all control rods places the plant in a condition that does not require the SLCS to be operable. The eight and twelve hour timeframes are consistent with the Standard Technical Specifications (NUREG 1202) and are more conservative than the present 24 hours to achieve shutdown. In addition, an explicit eight hours are allowed from the discovery of the total inoperability to attempt to fix the problem before initiating actions to bring the plant to hot shutdown.

## 2.7 Conclusion

The proposed TS changes discussed above are warranted in order to comply with the ATWS requirements of 10 CFR 50.62, to meet the SLCS shutdown requirements for future fuel cycles, and to clarify the TS. The staff has therefore concluded that the proposed changes increase the margin of nuclear safety and are acceptable.

### 3.0 ENVIRONMENTAL CONSIDERATION

The amendments involve a change to 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/or changes to the surveillance requirements. The 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 these amendments involve no significant hazards consideration and there has been no public comment on such finding. 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 nor environmental assessment need be prepared in connection with the issuance of these amendments.

### 4.0 CONCLUSION

The Commission made a proposed determination that the amendment involves no significant hazards consideration which was published in the Federal Register (53 FR 24516) on June 29, 1988 and consulted with the State of Alabama. No public comments were received and the State of Alabama did not have any comments.

The staff 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, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendments will not be inimical to the common defense and security nor to the health and safety of the public.

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Dated: September 2, 1988