

March 10, 1989

Mr. Oliver D. Kingsley, Jr.
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Dear Mr. Kingsley:

SUBJECT: UPPER HEAD INJECTION SWITCH SETPOINT AND HEAT FLUX HOT CHANNEL FACTOR (TAC RO0505) (TS 88-33)- SEQUOYAH NUCLEAR PLANT, UNIT 2

The Commission has issued the enclosed Amendment No. 95 to Facility Operating License No. DPR-79 for the Sequoyah Nuclear Plant, Unit 2. This amendment is in response to your application dated December 2, 1988.

This amendment modifies the Sequoyah Nuclear Plant, Unit 2 Technical Specifications (TS). The changes (1) revise the upper head injection (UHI) accumulator level switch setpoint and tolerances of surveillance requirement (SR) 4.5.1.2.c.1 and (2) reduce the heat flux hot channel factor (FQ(z)) limiting condition for operation (LCO) 3.2.2 and SR 4.2.2.2 from 2.237 to 2.15. The limit shall be 2.15 instead of 2.237 until an analysis in conformance with 10 CFR 50.46, using plant operating conditions and showing that a limit of 2.237 satisfies the requirements of 10 CFR 50.46(b), has been completed and submitted to NRC. This reduction in FQ(z) is a requirement of the Exemption from 10 CFR 50.46(a)(1) for operating Cycle 4 which was issued for Unit 2 on January 26, 1989. Similar amendments were approved for Unit 1 in the staff letters dated October 14, 1988 and January 23, 1989.

A copy of the Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's Bi-Weekly Federal Register Notice.

Sincerely,

Original signed by

Suzanne Black

Suzanne Black, Assistant Director
for Projects
TVA Projects Division
Office of Nuclear Reactor Regulation

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Enclosures:

- 1. Amendment No. 95 to License No. DPR-79
- 2. Safety Evaluation

cc w/enclosures:
See next page

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OFC	:NRR:TVA/LA	:NRR:TVA/PM	:OGC	:TVA/AD/P	:	:	:
NAME	:MSimms	:JDonohew	:SBlack	:	:	:	:
DATE	:2/15/89	:2/15/89	:2/17/89	:3/10/89	:	:	:

Mr. Oliver D. Kingsley, Jr.

-2-

Sequoyah Nuclear Plant

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-328

SEQUOYAH NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 95
License No. DPR-79

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Tennessee Valley Authority (the licensee) dated December 2, 1988, 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.

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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 Operating License No. DPR-79 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 95, 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.

FOR THE NUCLEAR REGULATORY COMMISSION


For Suzanne Black, Assistant Director
for Projects
TVA Projects Division
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance:

ATTACHMENT TO LICENSE AMENDMENT NO. 95

FACILITY OPERATING LICENSE NO. DPR-79

DOCKET NO. 50-328

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

REMOVE

3/4 2-4

3/4 2-5

3/4 2-6

3/4 2-6a

3/4 5-4

INSERT

3/4 2-4

3/4 2-5

3/4 2-6

3/4 2-6a

3/4 5-4

POWER DISTRIBUTION LIMITS

3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR- $F_Q(Z)$

LIMITING CONDITION FOR OPERATION

3.2.2 $F_Q(Z)$ shall be limited by the following relationships:

$$F_Q(Z) \leq \frac{[2.237^\#]}{P} [K(Z)] \text{ for } P > 0.5$$

$$F_Q(Z) \leq \frac{[2.237^\#]}{0.5} [K(Z)] \text{ for } P \leq 0.5$$

where $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

and $K(Z)$ is the function obtained from Figure 3.2-2 for a given core height location.

APPLICABILITY: MODE 1

ACTION:

With $F_Q(Z)$ exceeding its limit:

- a. Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower Delta T Trip Setpoints (value of K_4) have been reduced at least 1% (in ΔT span) for each 1% $F_Q(Z)$ exceeds the limit.
- b. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

SURVEILLANCE REQUIREMENTS

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

See Page 3/4 2-6a

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

4.2.2.2 $F_Q(z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

- a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.
- b. Increasing the measured $F_Q(z)$ component of the power distribution map by 3 percent to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties.
- c. Satisfying the following relationship:

$$F_Q^M(z) \leq \frac{2.237^{\#}}{P \times W(z)} \times K(z) \quad \text{for } P > 0.5$$

$$F_Q^M(z) \leq \frac{2.237^{\#}}{W(z) \times 0.5} \times K(z) \quad \text{for } P > 0.5$$

where $F_Q^M(z)$ is measured $F_Q(z)$ increased by the allowances for manufacturing tolerances and measurement uncertainty, F_Q limit is the F_Q limit, $K(z)$ is given in Figure 3.2-2, P is the relative THERMAL POWER, and $W(z)$ is the cycle dependent function that accounts for power distribution transients encountered during normal operation. This function is given in the Peaking Factor Limit Report as per Specification 6.9.1.14.

- d. Measuring $F_Q^M(z)$ according to the following schedule:
 1. Upon achieving equilibrium conditions after exceeding by 10 percent or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(z)$ was last determined,* or
 2. At least once per 31 effective full power days, whichever occurs first.

*During power escalation at the beginning of each cycle, power level may be increased until a power level for extended operation has been achieved and a power distribution map obtained.

#See Page 3/4 2-6a

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

e. With measurements indicating

$$\text{maximum over } z \left[\frac{F_Q^M(z)}{K(z)} \right]$$

has increased since the previous determination of $F_Q^M(z)$ either of the following actions shall be taken:

1. $F_Q^M(z)$ shall be increased by 2 percent over that specified in 4.2.2.2.c, or
2. $F_Q^M(z)$ shall be measured at least once per 7 effective full power days until 2 successive maps indicate that

$$\text{maximum over } z \left[\frac{F_Q^M(z)}{K(z)} \right] \text{ is not increasing.}$$

f. With the relationships specified in 4.2.2.2.c above not being satisfied:

1. Calculate the percent $F_Q(z)$ exceeds its limit by the following expression:

$$\left\{ \left(\text{maximum over } z \left[\frac{F_Q^M(z) \times W(z)}{\frac{2.237^\#}{P} \times K(z)} \right] \right) - 1 \times 100 \right\} \text{ for } P \geq 0.5$$

$$\left\{ \left(\text{maximum over } z \left[\frac{F_Q^M(z) \times W(z)}{\frac{2.237^\#}{0.5} \times K(z)} \right] \right) - 1 \times 100 \right\} \text{ for } P < 0.5$$

2. Either of the following actions shall be taken:
 - a. Place the core in an equilibrium condition where the limit in 4.2.2.2.c is satisfied. Power level may then be increased provided the AFD limits of Figure 3.2-1 are reduced 1% AFD for each percent $F_Q(z)$ exceeded its limit, or
 - b. Comply with the requirements of Specification 3.2.2 for $F_Q(z)$ exceeding its limit by the percent calculated above.

#See page 3/4 2-6a.

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

- g. The limits specified in 4.2.2.2.c, 4.2.2.2.e, and 4.2.2.2.f above are not applicable in the following core plane regions:
1. Lower core region 0 to 15 percent inclusive.
 2. Upper core region 85 to 100 percent inclusive.

4.2.2.3 When $F_Q(z)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2 an overall measured $F_Q(z)$ shall be obtained from a power distribution map and increased by 3 percent to account for manufacturing tolerances for further increased by 5 percent to account for measurement uncertainty.

#The limit shall be 2.15 instead of 2.237 until an analysis in conformance with 10 CFR 50.46, using plant operating conditions and showing that a limit of 2.237 satisfies the requirements of 10 CFR 50.46(b), has been completed and submitted to NRC.

EMERGENCY CORE COOLING SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

- b. At least once per 31 days and within 6 hours after each solution volume increase of greater than or equal to 1% of tank volume by verifying the boron concentration of the solution in the water-filled accumulator.
- c. At least once per 18 months by:
 - 1. Verifying that each accumulator isolation valve closes automatically when the water level in the water-filled accumulator is $92.0 + 2.6/-5.8$ inches above the tank vendor working line when corrected for the mass of cover gas.
 - 2. Verifying that the total dissolved nitrogen and air in the water-filled accumulator is less than 80 SCF per 1800 cubic feet of water (equivalent to 5×10^{-5} pounds nitrogen per pounds water).
- d. At least once per 5 years by removing the membrane installed between the water-filled and nitrogen bearing accumulators and verifying that the removed membrane bursts at a differential pressure of 40 ± 10 psi.



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

ENCLOSURE 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 95 TO FACILITY OPERATING LICENSE NO. DPR-79

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-328

1.0 INTRODUCTION

The Tennessee Valley Authority (TVA), by submittal dated December 2, 1988, proposed to modify the Sequoyah Nuclear Plant (SQN) Unit 2 Technical Specifications (TS). This is TVA's TS change number 88-33. The changes would (1) revise the upper head injection (UHI) accumulator level switch setpoint and tolerance band of Surveillance Requirement (SR) 4.5.1.2.c.1, and (2) reduce the heat flux hot channel factor (FQ(z)) of the Limiting Condition for Operation (LCO) 3.2.2 and SR 4.2.2.2 from 2.237 to 2.15.

The proposed Unit 2 UHI setpoint and tolerance change is consistent with the UHI setpoint and tolerance changes recently approved by the staff for Unit 1. The Unit 1 change (TS 88-20) was approved by letter dated October 14, 1988. Similarly, the proposed Unit 2 FQ(z) change is consistent with the Unit 1 FQ(z) change (TS 88-28) approved by letter dated January 23, 1989. The conclusions drawn herein supporting the proposed Unit 2 changes are the same as those drawn for TS changes 88-20 and 88-28 for Unit 1.

2.0 DISCUSSION

TVA Condition Adverse to Quality Report (CAQR) SQP871644 documents that the level switches and setpoints that were previously used could allow more than the analytical limit of 1,130.5 cubic feet of UHI water to be injected into the reactor coolant system (RCS) during a postulated accident. TVA has stated that two changes in the design and configuration of the UHI system were pursued to correct this problem. First, the minimum delivered UHI water volume was reduced from 900 cubic feet to 850 cubic feet. Second, a new model of level switch is being installed in the UHI system in the current Unit 2 Cycle 3 refueling outage. The new switches are essentially the same as those presently used, except for their span. Because of the span differences, the switches have different accuracy characteristics. The Demonstrated Accuracy Calculation 1-LS-87-21, provided by TVA submittal dated August 15, 1988, determined a new setpoint and tolerances based on the new instrument characteristics. These new values are proposed by TVA to be incorporated into SR 4.5.1.2.c.1 to ensure that the delivered UHI water volumes are bounded by the volumes assumed in the

large-break, loss of coolant accident (LOCA) analyses. This would in turn ensure that the offsite doses from a postulated LOCA are bounded by the analyses of Section 15.5 of the Sequoyah Final Safety Analysis Report (FSAR).

The proposed change in the delivered UHI water volume band described above is supported by Westinghouse Electric Corporation (WEC) evaluations. These calculations indicate that the potential decrease in delivered water volume to the core would result in increased peak clad temperatures (PCTs); but in all cases, the calculated PCT remains below the 2,200°F limit of 10 CFR 50.46. The worst case postulated LOCA scenario resulted in a calculated PCT of 2198°F, providing little margin for calculational or modeling error. The staff has previously indicated to TVA that operation of Units 1 and 2 could be supported by sensitivity studies provided an exemption to certain administrative requirements of 10 CFR 50.46(a)(1) was obtained and, that operational restrictions be imposed to provide at least 100°F of margin between the calculated PCT and the 10 CFR 50.46 limit. By letter dated January 26, 1989, the staff issued to TVA an exemption to certain requirements of 10 CFR 50.46(a)(1) for operating Cycle 4. Specifically, TVA's Sequoyah Plant has been exempted from having the Emergency Core Cooling System (ECCS) cooling performance based on plant operating conditions and calculated in accordance with an acceptable UHI evaluation model until the end of operating Cycle 4 for Units 1 and 2. The exemption was issued with conditions for additional operating restrictions including the limit of FQ(z) not to exceed 2.15. The other operational restriction is on the number of steam generator tubes plugged in the Unit 2 steam generators. TVA proposed in TS change 88-33 an FQ(z) limit of 2.15 for Unit 2.

Unit 2 is currently in its Cycle 3 refueling outage. The schedule is for it to restart from this outage and enter operating Cycle 4 on or about March 31, 1989. In its letter dated November 3, 1988, TVA stated that the UHI system will be removed in the Cycle 4 refueling outage and a 10 CFR 50.46 ECCS analysis without UHI will be submitted before Unit 2 restarts from the Cycle 4 refueling outage.

3.0 EVALUATION

TVA implemented two corrective actions to resolve the above mentioned CAQR. As discussed above, the first change is a proposed actual reduction in the total amount of water injected by the UHI system from the current requirement of 900 ft³ to 850 ft³; thereby, decreasing the probability of over injecting water from the UHI tank. Supporting WEC evaluations were provided by TVA in Attachment 1 of the December 2, 1988 submittal. The second CAQR corrective action is the replacement of the level switches with a new model. The new level switches are different only in the span of response. Only the switch accuracy calculations, therefore, are different. As justification for Unit 2, TVA has referenced the same calculations submitted to the staff by letter dated August 15, 1988 supporting TS change 88-20 for the setpoint and setpoint tolerances changes made for Unit 1.

Also in support of the proposed TS change for the UHI level switch setpoint, TVA has imposed certain operating restrictions for upcoming operating Cycle 4

of Unit 2 to provide at least 100°F margin between the calculated PCT and the regulatory limit of 2200°F established by 10 CFR 50.46(b). TVA stated that at least 100°F PCT margin can be obtained by administratively limiting the steam generator tube plugging (SGTP) to 5 percent and by reducing $FQ(z)$ from 2.237 to 2.15. As defined in FSAR Section 4.3.2.2.1, $FQ(z)$ is the maximum local heat flux on the surface of a fuel rod divided by the average fuel rod heat flux. Limiting this ratio minimizes the magnitude of localized "hot spots" along the fuel cladding surface. This in turn helps ensure that the PCT will remain below 2,200°F during a postulated LOCA.

3.1 UHI Injected Water Volume

As documented in FSAR Section 6.3.2, the UHI System is designed to passively provide additional water inventory to the reactor core during the blowdown phase of a postulated LOCA. The limiting case break, as documented in Emergency Core Cooling System (ECCS) Analysis, (FSAR, Section 15.4.1.1.4), is the double-ended, cold-leg guillotine (DECLG) break using a discharge coefficient, $C_D = 0.6$ with the imperfect mixing of UHI water assumed in the vessel upper head. This analysis established the lower bound value of injected water volume at 900 ft³. TVA proposed to lower this value to 850 ft³ and has provided a WEC analysis to support the conclusion that the increase in calculated fuel PCT remains below the 10 CFR 50.46 regulatory requirement of 2200°F. The reduction in the UHI water volume increased the PCT by 53°F and when PCT penalties for potential guide tube flexure failure and instrument guide tube filling during reflood are added, the limiting PCT reached 2198°F. This is less than the maximum acceptance criterion (2200°F) in 10 CFR 50.46.

3.2 Level Switch Setpoint Calculation

Level switches are used to automatically isolate the UHI System accumulators from the RCS after the UHI System has injected the borated water. The level switch setpoints are selected to ensure that the quantity of UHI water delivered is within the limits calculated for the large break LOCA analysis.

TVA has performed an accuracy calculation (1-LS-87-21) to demonstrate that level switch setpoint and tolerances will be within the bounds of the accident analysis. The TVA calculation is based on Static-O-Ring test report, 8601-042, using the sum of the squares method for all independent variables that affect accuracy. The bi-directional and uni-directional errors are combined in such a manner that the negative uni-directional error is added to the negative portion of the bi-directional error and the positive uni-directional error is added to the positive portion of the bi-directional error. The result is a corrective number for the instrument accuracy. The staff has reviewed the subject calculation, as is documented by letter to TVA on TS 88-20 for Unit 1 dated October 14, 1988, and the proposed TS for the level switch setpoint and tolerances (92.0 + 2.6/-5.8) and finds that the TS are acceptable because the accuracy calculation has been conducted in a manner which predicts the worst-case accuracy.

TVA has established the level switch setpoint based on the above accuracy calculation. However, the calculation was also based on the assumption that

the UHI system accumulator room temperature will be between 70°F and 85°F. UHI room temperature is monitored via Surveillance Instruction SI606 which requires that UHI room temperature be maintained between 75°F and 85°F. Since the margin between the safety limit and the instrument operating band was and still remains very small (.01" of water column), the staff conclusion remains that, anytime the temperature of the UHI room is not between 70°F and 85°F, the level switches should be declared inoperable. TVA committed in its letter to the NRC staff, dated September 21, 1988, to revise the balance-of-plant temperature monitoring procedure to indicate that the UHI level switches are inoperable if the ambient temperature in the area of the switches exceeds the values used in Demonstrated Accuracy Calculation 1-LS-87-21 to determine temperature-induced reference water-leg error. These values are the temperature values discussed above. This should be included in the next scheduled update of the FSAR.

3.3 PCT Margin and FQ(z) Change

To provide additional assurance that the PCT is below the 2200°F acceptance criterion, the following operational restrictions are imposed by TVA on Sequoyah, Unit 2:

1. The steam generator tubes plugged (SGTP) limit will be administratively lowered from 10 percent to five percent. Westinghouse has performed an analysis which demonstrates that this restriction reduces the calculated PCT by 22°F.
2. The FQ(z) limit will be lowered from 2.237 to 2.15 by rearranging the control rod positions during power operation. This reduces the calculated PCT an additional 87°F for the limiting imperfect mixing case.

By its application dated December 2, 1988, TVA provided evaluations conducted by WEC which showed that a reduction in FQ(z) from 2.237 to 2.15 reduces the PCT by 87°F for the limiting imperfect mixing case and by 96°F for the limiting perfect mixing case. As summarized on Page 4 of the WEC evaluation, this PCT reduction, combined with the reduction obtained by administratively limiting SGTP to 5 percent, results in PCTs of 2,089°F for the limiting imperfect mixing case and 2,067°F for the limiting perfect mixing case. These PCT values provide over 100 degrees of margin to the regulatory limit of 2200°F.

TVA has proposed that the FQ(z) limit for Unit 2 in LCO 3.2.2 and SR 4.2.2.2 shall be 2.15 instead of 2.237. Since the reduction in FQ(z) discussed above provides additional margin to the PCT regulatory limit of 2200°F, and the 2.15 limit will remain in effect until an analysis for the previously reviewed and accepted 2.237 limit in conformance with 10 CFR 50.46(a)(1) is submitted to NRC, the staff finds the proposed changes to the Unit 2 TS acceptable. The staff notes that, in accordance with 10 CFR 50.46, upon TVA submitting to NRC an analysis in conformance with 10 CFR 50.46 using plant operating conditions and showing that a limit of 2.237 satisfies the requirements of 10 CFR 50.46(b), the TS FQ(z) limit of 2.237 may be reinstated.

3.4 Staff Conclusions

Based on the above, the staff concludes that the proposed changes to the Unit 2 TS in TVA's application dated December 2, 1988 (TS 88-33) are acceptable. The staff also concludes that the Static-O-Ring level switches for the UHI accumulator System are inoperable if the room temperature is not between 70°F and 85°F. TVA committed in its letter dated September 21, 1988 to revise the balance-of-plant temperature monitoring procedure to indicate that the UHI level switches are inoperable if the ambient temperature in the area of the switches exceeds these values. This should be included in the next scheduled update of the FSAR.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change to a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes to the surveillance requirements. The 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 this amendment involves no significant hazards consideration and there has been no public comment on such finding. 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.

5.0 CONCLUSION

The Commission made a proposed determination that the amendment involves no significant hazards consideration which was published in the Federal Register (53 FR 53102) on December 30, 1988 and consulted with the State of Tennessee. No public comments were received and the State of Tennessee did not have any comments.

(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.

Principal Contributor: T. Rotella

Dated: March 10, 1989