



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

January 26, 1989

Docket Nos. 50-327/328

Mr. Oliver D. Kingsley, Jr.
Senior Vice President, Nuclear Power
Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. Kingsley:

SUBJECT: EXEMPTION TO 10 CFR 50.46(a)(1) FOR OPERATING CYCLE 4 -
SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 (TAC R00496, R00497)

By letter dated September 19, 1988, the Tennessee Valley Authority (TVA) requested a temporary exemption for Unit 1 from the requirement in 10 CFR Part 50.46(a)(1) for an Emergency Core Cooling System (ECCS) cooling performance analysis using approved calculation models and plant operating conditions. In that letter, and its letter dated August 15, 1988, TVA explained that the ECCS cooling performance analysis including the approved Upper Head Injection (UHI) calculation model, as referenced in Section 15.4 of the Sequoyah Final Safety Analysis Report (FSAR), was not based on plant operating conditions for the upcoming Cycle 4 operation and there were corrections needed to the UHI calculation model. An approved ECCS cooling performance analysis for Cycle 4 operation could not be submitted before the restart of Unit 1 in November 1988. The calculations by TVA to demonstrate that the fuel peak cladding temperatures (PCT) were below the acceptance criterion (2200°F) in 10 CFR Part 50.46 were based on sensitivity studies and the calculated ECCS performance in the FSAR. TVA accepted operating restrictions for Unit 1 on the maximum allowed heat flux hot channel factor and the percentage of steam generator tubes plugged. These restrictions reduced the PCT to more than 100°F below the acceptance criteria in 10 CFR Part 50.46.

By letter dated October 26, 1988, the Commission granted this temporary exemption until May 31, 1989 in accordance with the schedule stated in TVA's letter dated September 19, 1988. The Commission granted this Exemption on the conditions that: (1) the heat flux hot channel factor shall not exceed 2.15, and (2) the steam generator tubes plugged shall not exceed five percent.

Since being granted the above temporary exemption for Unit 1, TVA has reevaluated the resources needed to perform the required analysis for operation with UHI. TVA has concluded that these resources are great enough to delay its current plans to remove the UHI system from both units. This would be done in the Cycle 4 refueling outage for each unit which is scheduled for early and late 1990, respectively. Unit 1 is currently in operating Cycle 4 and Unit 2 is in operating Cycle 3 with the Cycle 3 refueling outage scheduled to begin in January 1989. During the Unit 2 Cycle 3 refueling outage, there will be changes

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Mr. Oliver D. Kingsley, Jr.

the Unit 2 UHI system. These changes will affect the ECCS cooling performance analysis in the FSAR for the Unit 2 operating Cycle 4. Unit 2, therefore, will have to have the same exemption discussed above and granted to Unit 1 on October 26, 1988, to restart from the Cycle 3 refueling outage for the same reasons.

By letter dated November 3, 1988 and supplemented by letters dated December 2 and 5, 1988, TVA has requested an exemption from the requirement of 10 CFR 50.46(a)(1) for an approved ECCS cooling performance with a correct UHI model for the entire operating Cycle 4 for both units. TVA requested that the temporary exemption discussed above and granted to Unit 1 be extended to include the entire operating Cycle 4 for both Units 1 and 2. TVA stated that it would have an approved ECCS cooling system using approved calculation models and plant operating conditions for operating Cycle 5 for both units. It stated that the resources saved by not performing a UHI/ECCS analysis could be better utilized elsewhere for safety improvements to the units.

Enclosed is the Exemption for Units 1 and 2 from the requirement in 10 CFR 50.46(a)(1) for a plant-specific ECCS cooling evaluation based on plant operating conditions and with an approved UHI model for operating Cycle 4. The Commission grants this exemption until the restart of the Units 1 and 2 for operating Cycle 5, in accordance with the schedule in TVA's letter dated November 3, 1988. The Commission granted this exemption on the condition that during operating Cycle 4: (1) the heat flux hot channel factor shall not exceed 2.15 and (2) the steam generator tubes plugged shall not exceed five percent. Before each unit may restart from its Cycle 4 refueling outage, the unit must have a plant-specific ECCS cooling evaluation based on plant operating conditions and an approved model to be in conformance with 10 CFR 50.46(a)(1).

In letters dated September 21 and December 2, 1988, TVA proposed amendments to the Unit 1 and 2 Technical Specifications (TS), respectively, to reduce the maximum allowed heat flux hot channel factor in the TS from the current value of 2.237 in the TS to the value of 2.15 required by the Exemption. The staff's action on these amendment requests will be the subject of separate letters after the Notices of Consideration of Issuance of Amendment in the Federal Register have expired for each unit. Even though the staff has not issued such an amendment to the TS, you are still required by the Exemption to operate Units 1 and 2 within the conditions of the Exemption.

Sincerely,
ORIGINAL SIGNED BY

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

Enclosure:
Exemption to 10 CFR 50.46(a)(1)

cc w/enclosure:
See next page
*SEE PREVIOUS CONCURRENCE

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Mr. S. A. White

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Sequoyah Nuclear Plant

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of
TENNESSEE VALLEY AUTHORITY
Sequoyah Nuclear Plant, Unit 1

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Docket No. 50-327

EXEMPTION

I.

The Tennessee Valley Authority (the licensee) holds Facility Operating License Nos. DPR 77 and DPR-79, which authorize operation of the Sequoyah Nuclear Plant, Units 1 and 2 (the facility, Units 1 and 2). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (the Commission) now or hereafter in effect.

The facility consists of two pressurized water reactors located on the licensee's site in Hamilton County, Tennessee.

II.

Section 50.46(a)(1) to 10 CFR Part 50 requires, in part, that for a pressurized light-water reactor, its plant-specific ECCS cooling performance shall be calculated in accordance with an acceptable evaluation model and for plant operating conditions. Furthermore, Section 50.46(b)(1) requires that the calculated maximum fuel element cladding temperature or peak clad temperature (PCT) from the ECCS performance during design basis accidents shall not exceed 2200°F.

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In its application for relief, the licensee stated that it was requesting an exemption from 10 CFR 50.46 for the operating Cycle 4 for Units 1 and 2. The request was for the licensee not to have to submit for operating Cycle 4 a calculated ECCS cooling performance analysis, using an approved Upper Head Injection (UHI) model and Cycle 4 plant operating conditions. The licensee would submit, for the beginning of operating Cycle 5, a calculated ECCS cooling performance using approved non-UHI models and Cycle 5 and beyond plant conditions for both units. The UHI system is presently planned to be removed during the Cycle 4 refueling outage, prior to operating Cycle 5, for both units.

By letter dated October 26, 1988, the Commission granted the licensee a temporary exemption until May 31, 1989 for Sequoyah Unit 1 from the above requirement in 10 CFR 50.46(a)(1) for a plant-specific calculated ECCS cooling performance analysis for operating Cycle 4. The licensee, in its request for this temporary exemption dated September 19, 1988 and the supporting documentation submitted in letters dated August 15 and September 21, 1988, informed the Commission that the existing ECCS cooling performance calculations using the UHI calculation model for Unit 1, as discussed in Section 15.4 of the Final Safety Analysis Report (FSAR), were no longer representative of the plant conditions for operating Cycle 4 for Unit 1. The licensee also stated that there were corrections needed for the UHI model. The licensee requested this temporary exemption to allow Unit 1 to operate in Cycle 4 until it could submit a plant-specific ECCS cooling performance based on plant operating conditions and with an approved UHI model but no later than May 31, 1989. The Commission granted this temporary exemption until May 31, 1989.

Since being granted the temporary exemption for Unit 1, the licensee has reevaluated the resources needed to perform the analysis of ECCS performance for operation with UHI. The licensee estimated that the cost of performing the UHI/ECCS analysis is more than \$1.1 million. The licensee states that resources of this magnitude are inconsistent with its plan to remove UHI at Units 1 and 2 in their respective Cycle 4 refueling outage. This outage follows the operating Cycle 4 for each unit.

Because both units will still have the UHI system in operation during the operating Cycle 4, the ECCS performance for both units for Cycle 4 would have to include an approved UHI calculation model without errors to be in conformance with 10 CFR 50.46(a)(1). Therefore, this required ECCS performance analysis with an approved UHI calculation model would be needed for only one operating cycle if UHI is removed in the Cycle 4 refueling outage.

Operating Cycle 4 for Unit 1 began in November 1988 and for Unit 2 is currently scheduled to begin on or about March 31, 1989. The Cycle 4 refueling outage for each unit will begin approximately 18 months later.

The licensee stated that the cost of a non-UHI/ECCS analysis would be about \$670,000 dollars. The licensee stated that the expenditure of resources for the UHI/ECCS analysis would delay the availability of resources needed to support removal of UHI from each unit and could, therefore, delay the present schedule for removing UHI in the Cycle 4 refueling outage for each unit.

The licensee further stated that the performance of the UHI/ECCS analysis would be a poor utilization of its resources, as well as NRC resources in reviewing the UHI/ECCS analysis, because of the age of the UHI model. The UHI evaluation model is not currently available for use and would require extensive resources to verify and validate on the current Westinghouse Corporation

computer system and, therefore, resources directed at the UHI/ECCS analysis would be directed toward "old" methodologies and technologies. The licensee further stated that Sequoyah is the last commercial plant utilizing the UHI design in this country and this would force the licensee to bear by itself the full burden for these resource expenditures.

The licensee discussed the safety significance of removing UHI from each unit. The removal of UHI will result in significant operation/maintenance improvements. During refueling outages, approximately four days of critical path work is required for disassembling, reassembling, and testing of UHI connections to the reactor vessel head. Deletion of this work would also result in decreased personnel exposure (approximately 59 person-rem each outage). The removal of UHI would also provide operation/maintenance improvements by the deletion of the surveillance requirements associated with UHI operability. UHI removal will also provide a safety benefit by removing the potential for injecting nitrogen into the reactor coolant system. Although injected nitrogen could occur only if multiple failures prevented the automatic isolation system from functioning properly, injected nitrogen could form voids in the reactor coolant system that might impede natural circulation and core cooling.

The licensee, in its letters dated November 3 and December 5, 1988, provided an assessment demonstrating the safe operation of Units 1 and 2 without the additional analysis required by 10 CFR 50.46(a)(1). The large break loss-of-coolant (LOCA) ECCS analysis for Unit 1, as documented in FSAR Section 15.4.1, was performed with the Westinghouse 1974 Evaluation Model. It resulted in a PCT of 2113°F. This analysis was based on a heat flux hot

channel factor ($F_Q(z)$) of 2.32, a discharge coefficient (Cd) of 0.6, and a lower bounding value of UHI water volume delivery of 900 cubic feet (ft^3).

In a TVA Condition Adverse to Quality Report (CAQR), the licensee identified that the current level switches used in the UHI system for both units potentially may allow more water to be injected during a postulated accident than the analytical limit of 1,130.5 ft^3 . The over injection of water can result in the accidental injection of nitrogen into the reactor coolant system. Nitrogen in the reactor coolant system could result in the restriction of heat removal from the fuel cladding. TVA implemented two corrective actions to resolve the above mentioned CAQR. Specifically, the first is a proposed actual reduction in the total amount of water injected by the UHI system from the current minimum requirement of 900 ft^3 , thereby, decreasing the probability of over injecting water from the UHI system. The reduction of the lower bounding value for UHI water volume delivery changes some of the original assumptions of the ECCS analysis. The second CAQR corrective action calls for the replacement of the level switches with modified switches whose characteristics present less instrument setpoint drift.

The licensee has performed a sensitivity assessment of the impact of delivering 50 ft^3 less of UHI water for the existing analysis to demonstrate that the PCT would remain below the regulatory limit of 2200°F. This assessment was provided to the Commission by submittals dated August 15 and 17*, and December 2, 1988, for Units 1 and 2, respectively. These submittals requested

* The submittal dated August 17, 1988 is a duplicate of the submittal dated August 15, 1988.

a change in Units 1 and 2 Technical Specifications (TS) on the UHI accumulator level switch setpoint. These requested TS changes proposed a reduction in the total amount of water injected by the UHI system discussed above. The sensitivity assessment of delivering 50 ft³ less UHI water was submitted also to support the requested TS changes.

The licensee stated that the magnitude of errors in the sensitivity studies is no more than those introduced through the use of the UHI evaluation model computer code. The sensitivities were determined from multiple runs of the UHI model. The multiple runs were performed to determine the effects on PCT of varying input parameters such as delivered UHI water volume, heat flux hot channel factor, and steam generator tube plugging. Therefore, because the sensitivities were determined directly from the UHI evaluation model, the error associated with them is inherent to the computer code.

Additionally, the licensee pointed out that confidence in the available PCT margin can be drawn from the new Appendix K rule to 10 CFR Part 50, "ECCS Evaluation Models" and from the loss-of-fluid test (LOFT) results. A summary of the rule changes as printed in the September 16, 1988, FEDERAL REGISTER acknowledged that "...the existing evaluation models are known to contain a large degree of overall conservatism...." The LOFT results indicated that PCT margin on the order of hundreds of degrees existed between predicted and experimentally measured PCTs.

The calculations showed that the new PCT was 2198°F. To provide assurance that Unit 1 is below the PCT limit of 2200°F, the licensee has limited the heat flux hot channel factor, $F_Q(z)$, by administrative control, to a value of 2.15, and lowered the steam generator tube plugging limit from 10 to 5 percent. The

licensee has stated that these two changes result in lowering the PCT to 109°F below the limit of 2200°F. The licensee has proposed a reduction in the current $F_Q(z)$ limit in the Units 1 and 2 Technical Specifications from 2.237 to 2.15 in submittals dated September 21 and December 2, 1988, respectively, for Units 1 and 2.

The licensee, therefore, contends that the performance of the confirmatory UHI/ECCS analysis will provide no significant benefit and its resources could be better utilized if directed at discretionary operation/maintenance improvements. Such discretionary improvements include the deletion of the boron injection tank (BIT) as discussed in Generic Letter 85-16. The licensee is also investigating discretionary operation/maintenance improvements associated with the ice condenser. These include reduced ice weight analyses and increased ice weighing intervals. The implementation of standardized, improved, and restructured technical specifications at SQN is also a discretionary operation/maintenance improvement. Many factors could affect the availability of funds for discretionary projects; for example, the recent Unit 1 forced outage to repair the Unit 1 main generator will alter the priorities placed on discretionary improvements.

Based on the above discussion, and the licensee's assessment of the impact on the calculated PCT with 5 percent steam generator tube plugging and the reduction of $F_Q(z)$ to a value of 2.15, the staff finds that an exemption is justified. This is a one-time temporary exemption from the requirement of 10 CFR 50.46(a)(1) for both Units 1 and 2 regarding having a calculated plant specific ECCS cooling performance evaluation using plant operating conditions and an acceptable evaluation model for only operating Cycle 4. The ECCS

cooling performance analysis required by 10 CFR 50.46(a)(1) would be a confirmatory analysis that the PCT for both units are below the regulatory limits. The basis for this exemption does not apply beyond operating Cycle 4 because the existing analyses for both units are for operation with UHI and the licensee will be removing the UHI system in the Cycle 4 refueling outage. The staff also finds acceptable the licensee's schedule for completing and submitting the ECCS re-analysis for operating Cycle 5.

III.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, this exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. The Commission further determines that special circumstances, as provided in 10 CFR 50.12(ii), are present justifying the exemption; namely, that the application of the regulation in the particular circumstances for operating Cycle 4 for both units would not serve and is not necessary to achieve the underlying purpose of the rule. The application of the regulation is not necessary, during operating Cycle 4 for each unit, to assure the integrity of the fuel cladding in the event of a postulated design basis LOCA because of the operational restrictions to be imposed on the units by the licensee will assure that the PCT for the units remain below the limit of 2200°F set forth in 10 CFR 50.46(b). Compliance with the rule would result in the expenditure of resources which are not consistent with the licensee's long term plans for the units and which could be better utilized elsewhere for safety improvements to the units.

Accordingly, the Commission hereby grants an exemption from 10 CFR Part 50.46(a)(1) for Sequoyah Units 1 and 2 for operating Cycle 4 as described above, provided:

1. Heat flux hot channel factor, $F_Q(z)$ shall not exceed 2.15.
2. Steam Generator Tube Plugging shall not exceed five percent.
3. The licensee shall complete a plant-specific ECCS analysis for Units 1 and 2 and shall submit the results of such an analysis for each unit before the unit enters its operating Cycle 5.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this Exemption will have no significant impact on the environment.

For further details with respect to this action, see the request for exemption dated November 3, 1988, and the supporting information submitted in letters dated December 2 and 5, 1988, which are available for public inspection at the Commission's Public Document Room, Gelman Building, 2120 L Street, N.W., Washington, D.C., and at the Chattanooga-Hamilton County Library, 1001 Broad Street, Chattanooga, Tennessee 37402.

This Exemption is effective upon issuance.

Dated at Rockville, Maryland, this 26th day of January, 1989.

FOR THE NUCLEAR REGULATORY COMMISSION



B. D. Liaw, Director
TVA Projects Division
Office of Nuclear Reactor Regulation

Transmitting Orders, Exemptions, Reliefs or Extensions

Docket File
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cc: Plant Service list