Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

September 29, 2000

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - TRITIUM PRODUCTION PROGRAM - ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)

As previously announced by the Department of Energy, TVA's SQN and Watts Bar Nuclear Plants have been selected for the production of tritium. In anticipation of a license amendment request by TVA for that purpose, this letter is providing an evaluation of the ATWS event for NRC review.

In July 1998, the Department of Energy submitted a report (NDP-98-153) prepared by Westinghouse Electric Company, entitled "Tritium Production Core (TPC) Topical Report," which presented technical information related to production of tritium in a commercial light-water reactor. As a result of its review of the TPC topical report, the NRC issued a safety evaluation report (NUREG-1672, May 1999) which listed 17 interface issues that must be addressed to support a plant-specific amendment for operation with a TPC. One of those issues is the need for NRC review of a plant-specific ATWS evaluation demonstrating acceptable system response. SQN's fuel vendor, Framatome Cogema Fuels, has performed an evaluation with tritium producing burnable absorber rods (TPBARs) installed. This evaluation is provided in the enclosure and demonstrates that a TPBAR core has a

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similar and better response to an ATWS event as a result of more negative moderator temperature coefficients (MTC) particularly in the early part of the cycle when MTC values are most positive and ATWS events are most limiting. Based on this evaluation, TVA has determined no further evaluations or analyses for the ATWS event are necessary. Watts Bar Nuclear Plant plans to provide their ATWS evaluation by separate correspondence.

This submittal contains no new commitments. Please direct questions concerning this issue to me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

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ENCLOSURE

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNITS 1 AND 2

TRITIUM PRODUCTION PROGRAM
ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)

An ATWS event is initiated by a design basis transient. Because of a postulated failure, however, control rod insertion does not occur following receipt of a reactor trip signal. The primary ATWS safety concern is the pressurization of the reactor coolant system and the potential for a failure of the reactor coolant pressure boundary. Therefore, those ATWS events initiated by a reduction in heat removal (e.g., a loss of feedwater event) are the most limiting events. Since control rod insertion is not credited, moderator feedback mechanisms dictate post-accident core power.

The moderator temperature coefficient (MTC) for Sequoyah is limited by plant technical specifications and is, by design, negative at all power levels and throughout core life for both tritium-producing burnable absorber rod (TPBAR) and standard cores. In a limiting ATWS event, reactor power reduction is accomplished via the negative reactivity feedback associated with increasing moderator temperature. The negative MTC, in conjunction with plant safety systems such as the auxiliary feedwater system and pressurizer code safeties, provides accident mitigation.

The MTC commonly includes both coolant density and boric acid feedback components. In a heatup event, coolant density is reduced and the neutron energy spectrum hardens slightly causing a reduction in fissions - a negative reactivity feedback component. However, a heatup and the accompanying coolant expansion results in soluble boron being expanded out of the core - with fewer neutron absorptions in boron. This is a positive reactivity feedback component.

MTC can be affected by the introduction of neutron absorbers, such as the lithium material in TPBARs, in a core. The large amount of poison in a TPBAR core reduces the soluble boron worth because of competing poison effects.

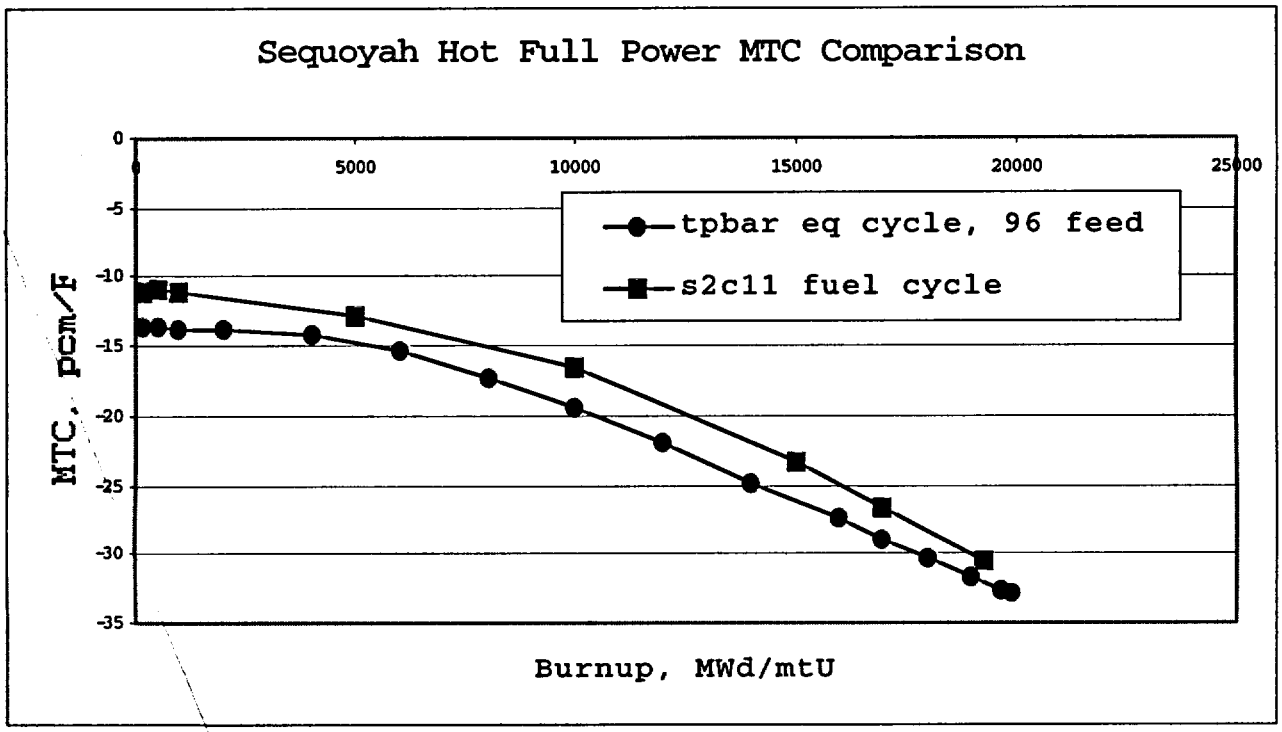
The attached figure shows a comparison of core MTC for both TPBAR and non-TPBAR cores. MTCs were generated for hot full-power conditions as a function of fuel burnup over the span of a fuel

cycle. The non-TPBAR core MTC was generated for the actual Sequoyah Unit 2 Cycle 11 core design. The TPBAR core MTC was generated for an equilibrium, 96 fresh fuel assembly feed batch, core design. During the early portion of the cycle when the MTC values are most positive, the tritium production core has a more negative MTC than the Sequoyah Unit 2 Cycle 11 core. This is due to the presence of a large number of TPBARs which reduce the worth of the soluble boron in the core. ATWS events are typically limiting during the early part of the cycle when the MTC values are most positive. Relative to Sequoyah Unit 2 Cycle 11, the tritium production core has a stronger feedback during this portion of the cycle.

The differences in the MTCs for these cores are within the cycle-to-cycle variability typically encountered. This cycle-to-cycle variability can be caused by: (1) different cycle energies which affect core excess reactivity and critical boron concentration, (2) different inventories of burnable absorbers between core designs, (3) differences in core loading patterns and fuel inventories, and (4) variability in previous cycle burnups. However, for a given soluble boron concentration and the other core parameters being equal, the tritium production cores will have more negative MTCs, particularly in the early portion of the cycle when ATWS events are more limiting.

Regardless of the details of the core design, the Sequoyah MTC Technical Specification requires that the MTC be less than 0 pcm/°F at all power levels. Currently, there are no plans to change this specification for tritium production cores. Furthermore, any change to this specification would require prior NRC approval. Future Sequoyah core designs incorporating TPBARs will have MTCs similar to current Sequoyah core designs and those depicted in the attached figure, within the normal cycle-to-cycle variability typically encountered.

Since moderator feedback for cores containing TPBARs will be comparable to current Sequoyah cores, the response of the tritium production cores to ATWS events will be comparable to the current cores as well. Therefore, based on this evaluation, TVA does not believe further ATWS evaluations or analyses are required for tritium production.


Sequoyah Hot Full Power MTC Comparison
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MTC, pcm/F
Burnup, MWd/mtU
tpbar eq cycle, 96 feed
s2c11 fuel cycle