Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

SEP 2 9 2000

10 CFR 50.4

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

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT - TRITIUM PRODUCTION PROGRAM - ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)

As previously announced by the Department of Energy, TVA's Sequoyah and Watts Bar Nuclear Plant's have been selected for the production of tritium. In anticipation of a license amendment request by TVA for that purpose, this letter is providing the enclosed Anticipated Transients Without Scram (ATWS) evaluation 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, NRC issued a safety evaluation report (NUREG-1672, May 1999) which listed seventeen interface issues which must be addressed to support a plant-specific amendment for operation with a tritium production core. One of those issues is the need for NRC review of a plant specific ATWS evaluation demonstrating acceptable system response. Watts Bar's NSSS vendor, Westinghouse, has performed an evaluation with tritium producing burnable absorber rods installed. This evaluation is provided in the enclosure and demonstrates that a TPBAR

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core has a similar, if not better, response to an ATWS event based on the moderator temperature coefficient remaining negative throughout the cycle. Based on this evaluation, TVA has determined no further evaluations or analyses are necessary. Sequoyah Nuclear Plant plans to provide their ATWS evaluation by separate correspondence.

This submittal contains no new commitments. Should you have any questions, please call me at (423) 365-1824.

Sincerely,

P. L. Pace,
Manager, Licensing and Industry Affairs

Enclosures
cc (See Page 3)

cc (Enclosure):

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ENCLOSURE
TRITIUM PROGRAM
ANTICIPATED TRANSIENTS WITHOUT SCRAM
NUREG 1672 - INTERFACE ITEM 17

ATWS Evaluation for the Watts Bar Tritium Production Cores

The primary concern associated with Anticipated Transients Without Scram (ATWS) events is the potential for overpressurization of the Reactor Coolant System. For overpressurization to take place following an ATWS event, two conditions must occur. These are: 1) a heat-up of the primary system coolant caused by a loss of normal feedwater and, 2) the failure of the control rods to insert normally following a reactor trip signal. A loss of normal feedwater occurs for the Loss of Normal Feedwater and Loss of Load ATWS events. The rise in primary coolant temperature leads to an increase in the primary system pressure and a decrease in reactor power. Since rod insertion following a reactor trip condition is not credited, the reactor power transient is primarily driven by natural reactivity feedback mechanisms. If sufficient negative core reactivity feedback occurs, the increase in primary system pressure may be limited to pressure conditions less than 3200 psig, the pressure corresponding to the ASME Service Level C stress limit applicable to Westinghouse PWRs.

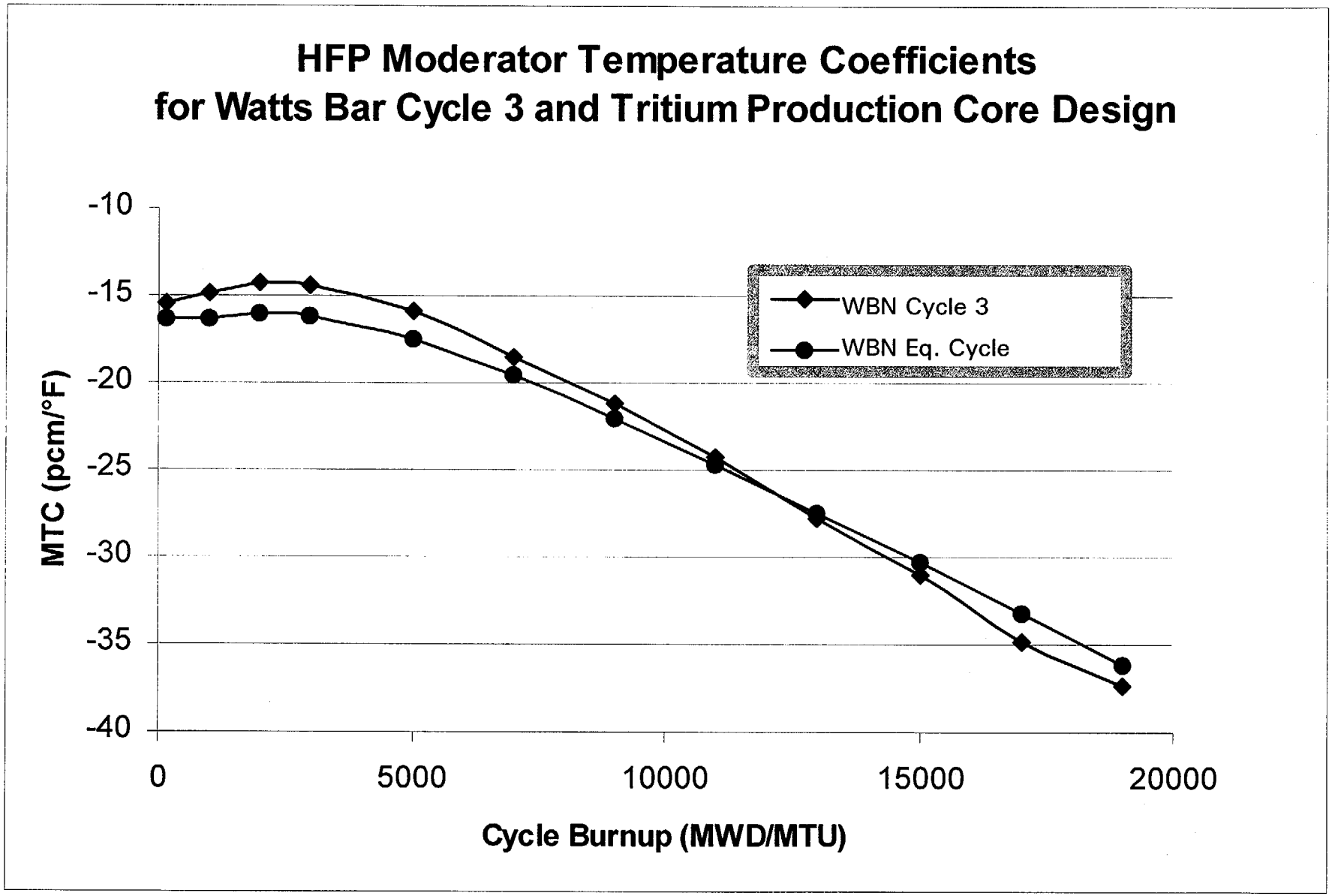
To assess the Watts Bar Tritium Production Cores (TPCs) for sensitivity to ATWS events, the moderator temperature coefficients (MTCs) for several Watts Bar TPC designs were calculated and compared to the MTC values for the current Watts Bar operating cycle, Watts Bar Cycle 3. Since the reactor power conditions following the pressure limiting ATWS events are largely dependent on the core reactivity feedback, the most important negative reactivity feedback mechanism leading to a drop in reactor power is the moderator temperature coefficient. All things being equal, reactor cores with comparable moderator coefficients will have comparable responses to ATWS events.

The attached figure gives the hot full power (HFP) MTC values as a function of cycle burnup for Watts Bar Cycle 3 and the Watts Bar equilibrium cycle TPC design. As the figure shows, the MTC values for the TPC design are quite comparable to the MTCs for Watts Bar Cycle 3. During the early portion of the cycle when the MTC is at its most positive values, the TPC core has slightly more negative moderator coefficients than Watts Bar Cycle 3. This is due in part to the presence of a large number of TPBARs

(Tritium Producing Burnable Absorber Rods), which reduce the worth of soluble boron in the core. Soluble boron has the effect of making the MTC more positive due to the smaller concentration of B-10 atoms in the moderator with increasing moderator temperature and decreasing moderator density. Lower soluble boron worths, therefore, result in more negative MTCs. Later in the cycle, when the MTCs become very negative, the cores continue to exhibit comparable MTCs, with the TPC core being slightly more positive than Watts Bar Cycle 3. ATWS events are typically limiting during the early part of the cycle when the MTC values are most positive. Relative to Cycle 3, the TPC design has slightly stronger feedback during this portion of the cycle.

The small 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) slightly different cycle energies, which affects core excess reactivity and critical boron concentration, (2) different inventories of burnable absorbers between core designs, (3) differences in loading patterns and fuel inventories, and (4) variability in previous cycle burnups. Regardless of the details of the core design, the current Watts Bar moderator temperature coefficient technical specification requires that the MTC be less than or equal to 0 $\Delta k/k°F$ at all power levels. Currently, there are no plans to change this specification for the Watts Bar Tritium Production Cores. Furthermore, any change to this specification would require prior NRC approval. Therefore, it is expected that future Watts Bar core designs incorporating TPBARs will have MTCs similar to current Watts Bar core designs and to those in the attached figure, within the normal cycle-to-cycle variability typically encountered.

Since the moderator feedback for the TPC designs will be comparable to current Watts Bar cores, the response of TPC designs to ATWS events will be comparable to the current cores as well. Therefore, based on this evaluation and since WBN is a zero or negative MTC Technical Specification plant, TVA does not believe further ATWS evaluations or analyses are required.


HFP Moderator Temperature Coefficients
for Watts Bar Cycle 3 and Tritium Production Core Design
MTC (pcm/°F)
-10
-15
-20
-25
-30
-35
-40
0
5000
10000
15000
20000
Cycle Burnup (MWD/MTU)
WBN Cycle 3
WBN Eq. Cycle