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

APR 27 2004

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 (WBN) UNIT 1 - TRITIUM PRODUCTION PROGRAM - PROGRAM ENHANCEMENTS

The purpose of this letter is to provide information related to certain enhancements made within the Tritium Production Program. As you are aware, Tennessee Valley Authority (TVA) is currently irradiating 240 Tritium-Producing Burnable Absorber Rods (TPBARs) for the U.S. Department of Energy (DOE) in cycle 6 of the Watts Bar Nuclear Plant, Unit 1 (WBN), as authorized by License Amendment No. 48 issued October 8, 2003. The irradiation of production quantities of TPBARs follows the irradiation of four Lead Test Assemblies (LTA), containing 32 TPBARs, in WBN Cycle 2. The approval to irradiate TPBARs was based on NRC review of material submitted by TVA and DOE.

As noted in Enclosure 4 of TVA's License Amendment Request for Tritium Production dated August 20, 2001, future enhancements to the production of TPBARs would be considered, as appropriate, to improve performance and increase uniformity of TPBAR quality. The enclosure to this letter provides the details regarding certain program enhancements. TVA intends to implement these model changes in June 2004.

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After reviewing these details provided in the enclosure and at your request, the TVA staff as well as the Pacific Northwest National Laboratory staff are available for further discussion.

There are no regulatory commitments associated with this submittal. If you have any questions or wish to discuss any of these matters further, please contact me at (423) 365-1824.

Sincerely,

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

Enclosure
cc: See page 3

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cc (Enclosure):
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ENCLOSURE
WATTS BAR NUCLEAR PLANT
TRITIUM PRODUCTION PROGRAM

The Tennessee Valley Authority (TVA) is currently irradiating 240 Tritium-Producing Burnable Absorber Rods (TPBARs) for the U.S. Department of Energy (DOE) in cycle 6 of the Watts Bar Nuclear Plant, Unit 1 (WBN), as authorized by License Amendment No. 48. The irradiation of production quantities of TPBARs follows the irradiation of four Lead Test Assemblies (LTA) containing 32 TPBARs in WBN Cycle 2. The approval to irradiate TPBARs was based on NRC review of material submitted by TVA and DOE as noted in the list of references.

Reference 8, Enclosure 4, noted that future enhancements to the production TPBARs would be considered, as appropriate, to improve performance and increase uniformity of TPBAR quality. One purpose of the post-irradiation examinations (PIE) of the LTA TPBARs was to provide information to test the analytical models and the modeling assumptions (Reference 7, Section 3.10, pg. 3-12). Another purpose was to provide experimental verification of estimates of the amount of tritium produced and the fractional tritium permeation release. (Reference 7, Section 3.10.4 pg. 3-13)

A model developed by Pacific Northwest National Laboratory (PNNL) served as the basis for estimating tritium permeation from the TPBARs to the reactor coolant system (RCS) in cycles 2 and 6. This model was developed from the fundamental science related to tritium production and transport within the TPBAR, as well as experimental work performed in the late 1980's through the early 1990's in the Advanced Test Reactor at the Idaho National Engineering and Environmental Laboratory. One factor used in the analyses was a Permeation Reduction Factor (PRF), which is the ratio of permeation of tritium through bare stainless steel cladding and permeation through coated SS cladding. Much of the experimental work performed to develop this relationship was performed on unirradiated material outside of a radiation field. It was known that the performance was affected by the presence of a radiation environment, but the testing in such an environment was limited. Therefore, conservative factors were applied. PNNL performed non-irradiated permeation testing on samples of each lot of coated cladding tubes to determine the acceptability of the tubes for use as cladding for TPBARs to be placed in the TVA reactors. Based on the model used and limited experience in a reactor environment, the acceptance criteria for the cladding tubes used in the LTA and the TPBARs currently in Watts Bar Unit 1 required a higher PRF in the design.

The non-destructive and destructive analyses of the LTA have since enabled PNNL to make refinements to the model used to calculate tritium permeation. The LTA PIE provided information that allowed the PNNL staff to better understand the tritium

movement within the TPBAR and the effect of a radiation environment on permeation, thus allowing them to refine the permeation model. The calculations used to develop the revised model, and the model itself, are classified. However TVA technical specialists have reviewed the models and participated in classified discussions with PNNL staff and TVA concurs with the model changes. In addition, TVA requested that PNNL have the model revision reviewed independently by experts at Sandia National Laboratory. The Sandia review concurred that the model changes are acceptable. TVA has previously reviewed the original model and its basis. As modified, the revised model supports the acceptance of coated cladding tubes with lower design PRF values while decreasing the predicted permeation through the cladding into the RCS. The revised model increases the margin between predicted tritium permeation and the TVA functional criterion of no more than 1000Ci/1000 TPBARs per year.

The revisions to the model and supporting calculations have been reviewed by PNNL in accordance with 10 CFR § 50.59 and it has been determined that they do not result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered; or in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses. TVA concurs with this review. The original design in-reactor PRF value was included in the classified submittal to the NRC (reference 6) and, therefore, TVA is informing the staff of this change. The revised model supporting calculations and PNNL's 10 CFR § 50.59 evaluation are available for staff review at the PNNL offices should a review be of interest to the staff. Additionally, PNNL and TVA staffs are available to discuss the details in a classified meeting space at PNNL at your request.

References:

1. PNNL-11419, Rev. 1, March 1997, "Report on the Evaluation of the Tritium Producing Burnable Absorber Rod Lead Test Assembly"

2. NUREG-1607, April 1997, "Safety Evaluation Report related to the Department of Energy's proposal for the irradiation of lead test assemblies containing tritium producing burnable absorber rods in commercial light water reactors"

3. TVA letter dated April 30, 1997, "Watts Bar Plant-Unit 1-Technical Specifications (TSs) Change 97-001—Tritium Producing Burnable Absorber Rod (TPBAR) Lead Test Assemblies (LTAs)"

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WATTS BAR NUCLEAR PLANT
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4. NRC letter dated September 15, 1997, "Issuance of Amendment on Tritium Producing Burnable Absorber Rod Lead Test Assemblies (TAC No. M98615)

5. NDP-98-181, Rev. 1, February 8, 1999, "Tritium Production Core (TPC) Topical Report", Unclassified and non-proprietary version

6. NDP-98-181, Rev. 1, February 8, 1999, "Tritium Production Core (TPC) Topical Report", Classified and Proprietary version

7. NUREG-1672, May 1999, "Safety Evaluation Report related to the Department of Energy's Topical Report on the Tritium Production Core"

8. TVA letter dated August 20, 2001, "Watts Bar Nuclear Plant-Unit 1- Revision of Boron Concentration Limits and Reactor Core Limitations for Tritium Production Cores (TPC)—Technical Specification (TS) Change No. TVA-WBN-TS-00-015"

9. NRC letter, September 23, 2002, "Watts Bar Nuclear Plant, Unit 1—Issuance of Amendment to Irradiate up to 2304 Tritium-Producing Burnable Absorber Rods in the Reactor Core (TAC No. MB1884)"