UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

50-390

July 24, 1997

LICENSEE: Tennessee Valley Authority

FACILITY: Watts Bar Nuclear Station, Unit 1

SUBJECT: SUMMARY OF JUNE 4, 1997 MEETING ON TRITIUM PRODUCING BURNABLE POISON ABSORBER RODS

On June 4, 1997, Nuclear Regulatory Commission (NRC) and Tennessee Valley Authority (TVA) representatives met at the NRC office (One White Flint North) to discuss TVA's application dated April 30, 1997, insertion of Lead Test Assemblies (LTAs) containing Tritium Producing Burnable Poison Absorber Rods (TPBARs) into the Watts Bar plant (WBN) for Cycle 2 operations. A list of attendees is provided in Enclosure 1. Several requests for additional information are included in Enclosure 2. A copy of the handouts provided by TVA and Department of Energy (DOE) for the meeting is included as Enclosure 3.

On April 30, 1997, TVA submitted an application for amendment of the WBN Technical Specifications to permit insertion of LTAs into WBN for Cycle 2 operations. This application included a copy of the DOE's report, PNNL [Pacific Northwest National Laboratory]-11419, Revision 1, "Report on the Evaluation of the Tritium Producing Burnable Absorber Rod Lead Test Assembly," dated March 1997. The NRC staff issued a Request for Additional Information (RAI) regarding TVA's license amendment application including the attached PNNL report on May 29, 1997. The RAI included areas where additional information was needed from a prior review of the PNNL report which was reported in an NRC Safety Evaluation Report related to DOE's proposal for the irradiation of lead test assemblies containing TPBARs in commercial light-water reactors, NUREG-1607, published May 1997. The items in Enclosure 2 reflect the status of items in an RAI letter from NRC to DOE dated April 21, 1997.

Principal among the topics that were discussed during the meeting were issues related to the safety classification of the TPBARs. Relative to this issue, TVA representatives stated that the TPBARs were considered safety-related consistent with Westinghouse's classification of burnable poison rods and that the basis for the safety-related classification of these components was that their location and design made them an essential element of the reactor core design. However, TVA emphasized that only the absorber pellet, absorber pellet stack, and the completed TPBAR (internal component location) were determined to have a safety function. Therefore, TVA maintained that only the attributes of the components that relate to the quality and distribution of absorber material were considered safety-related.

TVA responded to the NRC RAI of May 29, 1997 and the further RAI issues identified in Enclosure 2 in a letter dated June 18, 1997. The June 18, 1997 response to the safety classification of the TPBARs did not fully resolve the issue and the NRC staff addressed this issue further in a letter to TVA dated June 24, 1997.

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The meeting was beneficial in providing information on TVA/DOE/PNNL's position on the issues. The NRC staff's review of the issues continued following the June 4, 1997 meeting.

Robert Martin

Robert E. Martin, Senior Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures: 1. Attendance List
2. Request for Additional Information
3. Handouts provided by TVA, et al.

cc w/enclosures: See next page

cc:
Mr. Oliver D. Kingsley, Jr.
President, TVA Nuclear and
Chief Nuclear Officer
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Mr. O. J. Zeringue, Sr. Vice President
Nuclear Operations
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Jack A. Bailey, Vice President
Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. J. A. Scalice, Site Vice President
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

General Counsel
Tennessee Valley Authority
ET 10H
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. Raul R. Baron, General Manager
Nuclear Assurance and Licensing
Tennessee Valley Authority
4J Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Pedro Salas, Manager
Licensing and Industry Affairs
Tennessee Valley Authority
4J Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Paul L. Pace, Manager
Licensing and Industry Affairs
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Mr. Richard T. Purcell, Plant Manager
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Regional Administrator
U.S. Nuclear Regulatory Commission
Region II
61 Forsyth Street, SW., Suite 23T85
Atlanta, GA 30303-3415

Senior Resident Inspector
Watts Bar Nuclear Plant
U.S. Nuclear Regulatory Commission
1260 Nuclear Plant Road
Spring City, TN 37381

County Executive
Rhea County Courthouse
Dayton, TN 37321

County Executive
Meigs County Courthouse
Decatur, TN 37322

Mr. Michael H. Mobley, Director
Division of Radiological Health
3rd Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

The meeting was beneficial in providing information on TVA/DOE/PNNL's position on the issues. The NRC staff's review of the issues continued following the June 4, 1997 meeting.

original signed by R.Martin
Robert E. Martin, Senior Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

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HARD COPY W/ENCLOSURES 1, 2 AND 3
Docket
PUBLIC
WBN Rdg.
OGC
ACRS
R. Martin
J. Johnson

E-MAIL W/ENCLOSURE 1
S. Collins/F. Miraglia (SJC1,FJM)
R. Zimmerman (RPZ)
B. Boger (BAB2)
D. Ross (e-mail to SLM3)
K. Kavanagh (KAK)
J. Wilson (JHW1)
J. Davis (JAD)
K. Heck (JRH1)
S. Turk (SET)
N. Dudley (NFD)
R. Latta (RML1)
C. Willis (CAW)

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OFFICE	PDII-3/LA		PDII-3/LA		PDII-3/PD	C				
NAME	RMartin		BClayton		FHebdon					
DATE	07/24/97		07/23/97		07/24/97					

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LIST OF PARTICIPANTS

NRC - TVA MEETING ON WATTS BAR UNIT 1

JUNE 4, 1997

Name	Affilation
B. Martin	NRR/NRC/Watts Bar PM
K. Kavanagh	NRR/NRC/SRXB
T. Wilson	ORNL/Contractor to RS
R. Latta	NRC/NRR/HQMB
J. Wilson	NRC/NRR/PGEB
J. Chardos	TVA Project Manager
P. Pace	TVA - WBN Site Licensing Manager
R. Ankney	Westinghouse Core Engineering
J. Davis	NRC/NRR/EMCB
C. Folkers	Nuclear Information and Resource Service
M. Clausen	DOE/DP-62
R. Smoter	PNNL
M. Straka	NUS Information Services
T. Dunn	DOE/D8-21/QA
S. Sohinki	DOE/DP-62
K. Heck	NRC/NRR/HQMB
M. Travis	Westinghouse Electric
S. Turk	NRC/OGC
J. Ethridge	PNNL
C. Willis	NRR/NRC/PERB

ENCLOSURE 1

1. Regarding RAIs 1 & 2:

   PNNL/TVA/W will clarify, in further correspondence (docketed), their position regarding safety classification for the TPBARs. This correspondence will describe classification of subcomponents and methods used in that classification. The correspondence will also describe the correlation between the TVA safety/quality classification system and that used by PNNL (TTQP-1-046 or other appropriate document).

2. Regarding RAIs 3, 5, 13, and 17:

   PNNL/TVA/W will provide, in further correspondence, details of the reconciliation of PNNL QA program requirements (based upon NQA-1, 1989) against the requirements of the docketed TVA quality assurance plan (based upon ANSI N45.2 and daughter standards). This correspondence will also outline the approach taken by Westinghouse to assess the PNNL QA program against the requirements of the Westinghouse Quality Management System (QMS - based upon NQA-1, 1994 with commitments to Regulatory Guide 1.28).

3. Regarding RAI 8:

   PNNL will provide, in further correspondence, identification of any components for which dedication is required and a description of the dedication process. (If, consistent with the response to Item 1 above, only the 316SS bar stock must be dedicated, the process has been reviewed during the current inspection and no further description is necessary.)

4. Regarding RAI 10:

   PNNL will make available, during a future inspection, the Manufacturing And Quality Plan (MAQP) and any additional documents (e.g., inspection plans) necessary to fully describe the verification processes that will be employed to assure that TPBARs conform to design specifications.

5. Regarding RAI 11:

   PNNL/TVA/W will provide, in further correspondence or during an inspection, description of controls for transmittal of design information across interfaces between the design organization and TVA and Westinghouse. This will include PNNL procedures TTQP-1-021 and TTQP-1-058, the TVA tritium project plan, and any other documents controlling such transmittals.

6. Regarding RAI 21:

   PNNL will provide, in further correspondence or during a future inspection, a copy of the MAQP and any other documents (e.g., weld specifications, welding procedures, welding process qualifications, etc.) necessary to fully describe the welding process used to attach the endplugs to the TPBAR cladding.

Thermal-Hydraulics and Reload Analysis

(a) Page E5-1 of TVA's application dated April 30, 1997 states that "the TPBAR final thermal-hydraulic analysis assumed an assembly average relative power of 1.40, a peak rod adjacent to the TPBAR with an F delta h of 1.65, and the peak TPBAR heat generation rate. The TPBAR meets thermal-hydraulic design criteria using these assumptions. By design, the TPBAR LTAs will be loaded in core locations that have non-limiting assembly average relative powers in order to conform with WBN Technical Specification 4.2.1 which requires that lead test assemblies be placed in non-limiting core locations. The TPBAR host assembly power will be monitored to ensure that assembly power is maintained at levels consistent with the assumed assembly average relative power of 1.40." This statement only addresses the assumed thermal-hydraulics of the TPBAR not the thermal-hydraulic effect of the TPBAR in different locations throughout the core. Provide the thermal-hydraulic analyses of the reactor core with the TPBAR LTAs in the proper and mislocated positions.

(b) Page E6-1 states that "the TPBAR host assembly power will be monitored to ensure that assembly power is maintained at levels consistent with the assumed assembly average relative power of 1.40." Please describe the monitoring frequency, action levels, and reactor operator compensatory actions.

(c) When will the plant-specific reload safety evaluation in support of the Cycle 2 core reload be complete and available for staff review if necessary?

ENCLOSURE 3

NRC/TVA MEETING

LEAD TEST ASSEMBLY FOR TPBARS

JUNE 4, 1997

6.4 pres.doc

AGENDA

Opening Remarks	**TVA**
Status of Outstanding Issues	**PNNL/W/ TVA**
1. Quality Assurance (Item 15)	
2. Materials (Items 1 - 5,12,13)	
3. Reactor Core Evaluations (Items 6 -10, 11, 14, 16, 17, 18)	
Schedule for Remaining Activities	**TVA**

Issue 1 - ASME B&PV Code Edition Referenced in TPBAR Mechanical Design

- TPBAR pressure boundary is not safety-related
- TPBAR pressure boundary not an ASME Class I, II, or III component
- 10 CFR 50.55a processes not applicable to TPBARs
- Relief request not required since code does not apply
- Section III of the ASME code used as design guidance - Standard industry practice
- PNNL compared the 1995 edition with the 1989 edition - no relevant differences

Issue 2 - TPBAR Cladding Purchase Requirements

- Technical Report references ASTM A 771 to physically describe material- not purchase/QA requirements
- TPBAR cladding purchase orders:
  - Implement requirements of the PNNL QA program that complies with 10 CFR 50, Appendix B and ANSI/ASME NQA-1
  - Require conformance to the PNNL cladding specification document
  - TPBAR cladding specification also references ASTM A-771 to physically describe material
  - Cladding specification contains technical requirements supplementing ASTM A-771
- Cladding bar stock material for TPBARs was dedicated. The dedication was reviewed in the NRC inspection of April 28, 1997 and found to be acceptable

Issue 3 - Effects of Thermal Cycling

- **Technical report Section 2.2.1.3 addresses thermal cycling and resulting clad fatigue during normal and transient operating conditions**
- **The ASME Code was used as a guide for the analysis methodology and acceptance criteria**
- **Testing and analysis of cladding performance meets acceptance criteria**
- **More detailed information regarding thermal cycling of the barrier coating will be provided in a response prior to 6/13/97 (classified)**

Issue 4 - Metal-Metal Interactions During Design Basis LOCA

- **TPBAR assumed to fail at 1500 degrees F due to loss of material strength and internal pressure**
- **Classified Technical Report identifies lowest eutectic temperature of concern - substantially above 1500 degrees F**
- **Since the rod has assumed to have failed, this issue is not a factor in TPBAR DBA LOCA failure mode**
- **Memo AWC-106.97-Draft (Cronenberg) confirmed there are "no show stopper problems" related to this issue**
- **Additional information from analyses that confirm this conclusion regarding metal-metal interactions will be provided in a response prior to 6/13/97 (classified)**

Issue 5 - TPBAR Analytical Model

- **Conservative assumptions (e.g. inputs) were used in the analytical model to ensure results satisfactorily predict rod performance - test data confirm these results**
- **Model is available for NRC review**
- **Additional information from PNNL analyses that demonstrate the model calculates conservative temperatures and pressure will be provided in a response prior to 6/13/97 (classified)**

Issue 6 - Comparison of Reactivity Characteristics of TPBAR to BPRAs.

- Reactivity worth of TPBARs will be compared with WABAs as a function of LTA Assembly burnup
- TPBARs are explicitly modeled in the physics codes. Effects of TPBARs will not be accommodated by using up design margins
- Any reactivity differences will be explicitly assessed as part of the Reload Safety Evaluation for Cycle 2 and will ensure compliance with all core design limits
- Results of this reactivity comparison will be provided in a response prior to 6/13/97

Issue 7 - Cycle 2 Reload Analysis

- Reload Analysis will ensure compliance with all core design limits
- Preliminary evaluations have been done for the maximum, nominal, and minimum burnup windows
- Key parameters are within design limits
  - $F\Delta H$
  - MTC
- Reload Safety Evaluation (RSE) is expected to show that the reference safety analysis remains valid. No Tech Spec changes are anticipated
- Final RSE is scheduled for completion on August 28

Issue 8 - Analysis of 400-mil Pellet Gap

- **400-mil gap is a bounding neutronics analysis case performed using the DORT code**
- **Actual gap expected to be significantly less**
- **Analysis of gap is conservative and takes into account:**
  - **Worst case manufacturing tolerances**
  - **Worst case dimensional changes (swelling, thermal expansion, etc.)**
- **An MCNP neutronics analysis will be performed to complement the DORT analysis and confirm peaking prediction**
- **Results of MCNP analysis will be provided in a response at a later date**

Issue 9 - Maximum Negative Worth of the TPBAR

- **Westinghouse will evaluate the effects of a lengthy shutdown near the end of Cycle 2 on the TPBAR worth**
  - **He-3 buildup is the issue**
  - **3 month shutdown will be assumed at 80% of the cycle length**
- **Results of this evaluation will be provided in a response prior to 6/13/97**

Issue 10 - Benchmarking of PHOENIX-P Code

- **A letter was issued to the staff in March which identified the process for changing and benchmarking the PHOENIX-P Code**
- **No further action required**

Issue 11 - Thermal-hydraulic Analysis for Watts Bar Cycle 2

- **Thermal-hydraulic analysis has been completed, documented, and is available for audit**
- **All plant specific input parameters used in the final analysis are Watts Bar Cycle 2 values**
- **The analysis has been reviewed and accepted by Westinghouse**
- **Thermal-hydraulic analysis demonstrates that the TPBARs will not adversely affect WBN thermal-hydraulic design and meets all acceptance criteria**
- **No further action planned**

Issue 12 - Weld Qualification

- Weld and welding qualification performed per PNNL welding specification
- Relevant industry consensus standards implemented in the PNNL welding specification including ASTM E3 and E833
- Comparison of the PNNL welding specification and ASME Section IX indicates that the welding specification meets or exceeds the requirements of ASME Section IX
- TPBAR welding processes are performed under the Manufacturing and Quality Assurance Plan (MAQP) - will be approved by Westinghouse

Issue 13 - Nondestructive testing techniques and applicable standards

- PNNL has developed component specifications that address NDE of TPBAR materials
- Relevant industry consensus standards implemented in component specifications
- PNNL and its subcontractors comply with the requirements of the component specifications

Issue 14 - Inadvertent Loading and Operation of an LTA in an Improper Position

- TPBARs will suppress the power in any assembly that they reside due to their negative reactivity effect
- Maximum predicted fuel assembly power peaking is less than 1.40 for Cycle 2. TPBAR thermal/hydraulic evaluations show acceptable performance in fuel assemblies having power peaking of 1.40 or less
- Combining peak fuel powers with peak TPBAR powers is conservative
  - TPBAR heating rates peak at beginning of cycle
  - Fuel assemblies containing TPBARs or BPRAs peak at end of cycle
- Any misloading will cause the misloaded assembly to operate at a power less than the intended power.

Issue 15 - Quality Assurance Program

- The specific QA issues being addressed are documented in the April 21, 1997 NRC letter
- The letter identifies 21 issues
- Most issues are being addressed through the on-going NRC inspections at PNNL
- For those issues not directly addressed during these inspections, a response will be provided prior to 6/13/97. The two QA program issues that will be responded to are:
  - TPBAR Safety Functions
  - Utilities Requirements / ANSI N45.2 and NQA-1

Issue 15-Q1 - TPBAR Safety Functions

- Presence and the location of burnable absorbers, soluble boron, and control rods, determine level of reactivity to keep the reactor in a safe state
- 10 CFR 50, Appendix B and 10 CFR Part 21 are applicable
- Consistent with Westinghouse classification of other absorber rods
- The following TPBAR items have been determined to affect safety function and are considered safety-related:
  - Absorber pellet
  - Absorber pellet stack
  - Completed TPBAR (internal component location)
- Only those attributes of the above components that relate to the quantity and distribution of absorber material are considered safety-related
- PNNL documentation (safety characteristics) is being revised to reflect this information
- Placement of the LTA in the proper core location is considered a safety-related activity

Issue 15-Q2 - Utility Requirements / ANSI N45.2 and NQA-1

- RG 1.28 conditionally endorses NQA-1-1983 and ANSI N45.2 series standards as acceptable means of meeting 10 CFR 50 Appendix B
- NRC-accepted TVA quality program based on ANSI N45.2 series standards
- QA requirements passed down to W & PNNL from TVA by contract
- W found acceptable as a supplier under TVA quality program.
- W performed qualification audit of PNNL under contract to TVA and found PNNL to be qualified
- Results of comparison between NQA-1-1983 and NQA-1-1994 confirming no reduction in requirements will be supplied as part of the 6/13/97 response

Additional QA Related Issues Subjects to Reviews During NRC inspections:

Issue 15-Q3

- **RAI 8, regarding commercial grade dedication, was covered by review of 316SS bar stock dedication during recent NRC inspection (no other material is subject to dedication) and found acceptable**

Issue 15-Q4

- **RAI 10, regarding verification processes, will be addressed in a future NRC inspection of the Manufacturing and Quality Plan (MAQP) and PNNL inspection plans**

Issue 15-Q5

- **RAI 11, regarding transmittals of design information, will be addressed in a future NRC inspection of administrative controls, including the TVA Tritium Project Plan and related PNNL procedures**

Issue 15-Q6

- **RAI 21, regarding qualification of special processes, will be addressed in a future NRC inspection of the MAQP, weld specifications, weld procedures, and weld qualification documentation and will be concurred with by W**

The following additional QA related issues are closed, subject to further review during NRC inspections:

- **RAIs 4, 12 & 18, regarding contract relationships and QA oversight**
- **RAIs 6 & 7, regarding procurement QA**
- **RAI 9, regarding management assessments and audits**
- **RAI 14, regarding the Westinghouse QA program being applied**
- **RAI 15, regarding design organization**
- **RAI 16, regarding reporting of nonconformances**
- **RAI 19 and 20, regarding Westinghouse and utility verification processes**

Issue 16 - Refueling Operations

- **Current WBN FSAR maximum design spent fuel pool heat load is 26.27 x 10^6 BTU/hr from 1312 assemblies**
- **Following Cycle 2 there could be a maximum of 357 assemblies in the SFP, assuming a full core off load**
- **The excess SFP cooling capacity following Cycle 2 is >19 x 10^6 BTU/hr**
- **4 LTAs (32 TPBARs) generate <328 BTU/HR**
- **Heat load of 4 LTAs will be within the SFP cooling system capability**

Issue 17 - Anticipated Transient Without Scram (ATWS)

- **Moderator Temperature Coefficient (MTC) is important to ATWS**
- **Inclusion of TPBAR LTAs makes MTC slightly more negative**
- **More negative MTC makes ATWS consequences less severe**

Issue 18- Thermal-Hydraulics and Reload Analysis

Issue 18 (a) - Average Relative Power of 1.40

- **See Issue 14**

Issue 18(b) - Host Assembly Monitoring

- **Power will be reduced if the TPBAR average relative assembly power exceeds 1.40 at RTP**
- **Will be monitored at same frequency as FNDH as required by WBN TS 3.2.2**
- **If measured assembly average relative power value is exceeded, power will be reduced 1.5% RTP from 100% RTP for every 1% that the LTA host assembly exceeds 1.40 at RTP**

Issue 18.(c) Reload Analysis

- **The Reload Safety Evaluation is scheduled for completion on August 28, 1997.**