50-390

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

August 1, 1997

see report

LICENSEE: Tennessee Valley Authority

FACILITY: Watts Bar Nuclear Station, Unit 1

SUBJECT: SUMMARY OF JULY 3, 1997 MEETING ON TRITIUM PRODUCING BURNABLE POISON ABSORBER RODS

On July 3, 1997, Nuclear Regulatory Commission (NRC), Tennessee Valley Authority (TVA), Department of Energy (DOE), Pacific Northwest National Labs (PNNL) and Westinghouse representatives met at the NRC office (One White Flint North) to discuss TVA's application dated April 30, 1997 regarding 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. A copy of the handouts provided by TVA and DOE for the meeting is included as Enclosure 2. A copy of the transcript of the meeting is provided in Enclosure 3.

On April 30, 1997, TVA submitted an application for amendment of the WBN Technical Specifications (TS) to permit insertion of LTAs into WBN for Cycle 2 operations. The NRC staff issued a Request for Additional Information (RAI) on May 29, 1997. This was followed by a meeting between the NRC staff and TVA, et al. on June 4, 1997 and TVA's response to the RAI on June 18, 1997. The June 18, 1997 response to the issue of the safety classification of the TPBARs did not fully resolve the issue and the NRC staff addressed this further in a letter to TVA dated June 24, 1997. The meeting of July 3, 1997 was held at TVA's request to present a response to the NRC staff's letter of June 24, 1997.

Two key issues were discussed in this meeting. The issue identified as Question 1 in the staff's RAI of May 29, 1997 addressed the relationship of American Society of Mechanical Engineers (ASME) Code to TPBAR design. The discussions in the meeting were very beneficial in supporting the NRC staff's review of this issue. The issue was further addressed by TVA in a letter to the NRC dated July 21, 1997, "Lead Test Assemblies - ASME Boiler and Pressure Vessel (B&PV) Code Requirements."

Substantial progress was made on the issue relating to the safety classification of the TPBARs. In support of this discussion, a revised version of the Tritium Target Qualification Project report, TTQP-1-046 was presented in the meeting. This was followed by TVA's letter of July 21, 1997, "NRC Letter Dated June 24, 1997 Regarding the Tritium Producing Burnable Poison Rod (TPBAR) Lead Test Assemblies (TAC No. M98615)."

In addition to the two letters mentioned above, submitted by TVA on July 21, 1997, a third letter dated July 21, 1997, was submitted responding to the RAI letter item of June 18, 1997 regarding the PHOENIX-P/ANC Computer Software Changes.

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The meeting and the documentation of TVA's responses in the above mentioned letters were beneficial in providing information on TVA/DOE/PNNL's position on the issues. The NRC staff's review of the issues continued following the July 3, 1997 meeting.

Original signed by

Robert E. Martin, Senior Project Manager
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Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures:
1. Attendance List
2. Handouts provided by TVA, et al.
3. Transcript of July 3, 1997 Meeting

cc w/enclosures: See next page

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The meeting and the documentation of TVA's responses in the above mentioned letters were beneficial in providing information on TVA/DOE/PNNL's position on the issues. The NRC staff's review of the issues continued following the July 3, 1997 meeting.

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NRC - TVA MEETING ON WATTS BAR UNIT 1

JULY 3, 1997

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Suzanne Black	NRC/DRCH/HQMB
Cecil Thomas	NRC/DRCH
Dick Wessman	NRC/DE/EMEB
Steven M. Matthews	NRC/NRR/DISP/PSIB
Jim Wilson	NRC/NRR/DRPM/PGEB
R. M. Latta	NRC/NRR/DRCH/HQMB
Glenn Tracy	NRC/OEDO
Gerald Sorensen	PNNL
Jim Chardos	TVA
Paul Pace	TVA-WBN-LICENSING
Jerry Ethridge	Pacific NW National Lab (PNNL)
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Roy Zimmerman	NRR/NRC
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Scott Newberry	NRC/NRR/DSSA
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Hans Garkisch	Westinghouse
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ENCLOSURE 1

NRC/TVA/DOE MEETING
WATTS BAR LTA AMENDMENT
July 3, 1997

AGENDA

1. Safety Classification
2. Design Margins
3. FSAR
4. Reload Safety Evaluation
5. Status of Remaining NRR Review

ENCLOSURE 2

Summary of July 3, 1997 Meeting on Tritium Producing Burnable POison Absorber Rods

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TRITIUM TARGET QUALIFICATION PROJECT

TPBAR COMPONENT CHARACTERISTICS AND RELATED IMPORTANCE FACTORS

TTQP-1-046

REVISION 3 DRAFT

JULY 1997

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TRITIUM TARGET QUALIFICATION PROJECT

TPBAR COMPONENT CHARACTERISTICS AND RELATED IMPORTANCE FACTORS

Revision 3 DRAFT

July 1997

Prepared by:	RJ Migliore, Preparer	Date
Reviewed by:	TTQP Authorized Derivative Classifier	Date
Approved:	TTQP Quality Engineer	Date
Approved:	DL Rittenhouse, Task 1 Manager	Date
Approved:	RJ Guenther, Task 2 Manager	Date
Approved:	JL Ethridge, Project Manager	Date
Concur:	J Chardos, TVA	Date

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TPBAR COMPONENT CHARACTERISTICS AND RELATED IMPORTANCE FACTORS

The proper design and fabrication of tritium producing burnable absorber rods (TPBARs) is vital to the success of the Lead Test Assembly (LTA) mission of demonstrating safe, reliable, and economic tritium production in a commercial light water reactor. The following describes the significance of the TPBAR and its components to the success of the LTA mission.

TPBAR LTA Safety-Related Function. In all respects, with the exception of tritium production, the TPBARs function as burnable absorber rods. Burnable absorbers are an essential element of a reactor core design. The presence and the location of the absorber rods, in conjunction with soluble boron and control rods, determine the appropriate level of reactivity to keep the reactor in a safe state. TPBAR LTAs have no active reactivity control function but do have passive reactivity characteristics. Therefore, the TPBAR LTAs are integral part of the reactivity control system and are safety-related.

Because the TPBAR LTAs perform a safety-related function, the 10 CFR 50, Appendix B, quality assurance program and 10 CFR Part 21 are applied to the design, procurement, fabrication, assembly and handling of the TPBAR LTAs.

Individual TPBAR component failures cannot result in the inability of the TPBAR LTAs to perform their safety function. However, there are fabrication and installation errors associated with TPBARs that could affect the TPBAR LTA safety-related function if the reactivity characteristics or location of multiple TPBARs are substantially different from that assumed in core design. In addition, the TPBARs should maintain their mechanical integrity in order to ensure the location of the absorber within the TPBARs.

The relationship between these safety functions and the TPBAR components is described in Table 1.

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Table 1. Safety Function of TPBAR Components

Component	Safety Function
Lithium Aluminate Pellet/Stack	The lithium aluminate pellet/stack provides the reactivity control function of the TPBAR.
TPBAR Cladding, End Plugs, and Weld	The cladding, end plugs, and welds form the principal structural component of the TPBAR and therefore are essential to ensure the location of the absorber within the TPBAR.
Getter and Liner Tube	The getter and liner tube affect the position of the pellets and therefore the location of the absorber within the TPBAR.
Compression Spring	The compression spring prevents movement of the pencils during shipping and handling prior to irradiation, preventing possible damage to the pellets. Damage to the pellets could affect the location of absorber material within the TPBAR.

Radiological Significance. The TPBARs produce tritium and, therefore, the tritium retention performance of the TPBAR can affect occupational and offsite radiological doses. The TPBAR assembly, TPBAR cladding (cladding tube, end plugs, and aluminide coating), lithium aluminate pellets, and getter can affect tritium retention performance of the LTAs.

The radiological significance of the TPBAR is not safety related because TPBAR failure cannot result in potential offsite exposures comparable to those referenced in 10 CFR 100.11.

Mission Performance. The TPBARs must produce design goal amounts of tritium without adverse impacts or limitations on fuel assembly fabrication, shipment, or LTA host plant operations. These requirements must be satisfied while demonstrating a consistent and cost effective TPBAR fabrication process.

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Manufacture of TPBARs involves the purchase of materials and components. Components will undergo processing, fabrication, and inspection, both at offsite component vendors and at the Pacific Northwest National Laboratory (PNNL). These components have design characteristics that are required to meet the Functional Requirements for the LTA.

Verification of these characteristics is vital to the success of the LTA mission. Because not all TPBAR component characteristics are of equal importance, the level of inspection and verification will vary. This document lists the TPBAR components and their characteristics and categorizes the characteristics according to their importance. Five "importance factors" have been defined. In descending level of importance, they are termed Category A through E[a].

Definitions:

Category A - A TPBAR characteristic that, if not within specified limits, can affect the ability of the TPBAR LTAs to perform their function of maintaining the reactor core in a safe state.

Category B - A TPBAR characteristic other than Category A that, if not within specified limits, could (1) result in incremental tritium releases and either onsite or offsite doses, or (2) result in localized core power peaking, or (3) significantly affect mechanical integrity of the TPBAR.

Category C - A TPBAR characteristic other than Categories A or B that, if not within specified limits, could impact the location of absorber material within the TPBAR, result in excessive costs for fuel and plant operations, or result in substantial delays in scheduled shipping dates.

Category D - A TPBAR characteristic other than Categories A, B, or C that, if not within specified limits, may result in unacceptable rates of defects or rework, and/or poor fabricability.

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[a]These categories were formerly titled Critical, Major 1, Major 2, Minor 1 and Minor 2 in earlier versions of this document.

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Category E - A TPBAR characteristic other than Categories A, B, C, or D that, if not within specified limits, does not impact safety or significantly impact cost or schedule.

The importance factors defined in this document are used as a basis to determine the type and frequency of inspection tests to be performed by both the offsite component vendors and PNNL. This document does not specify where the verification will occur (i.e., vendor or PNNL), simply that it must occur prior to final TPBAR acceptance. Note that this document gives the minimum characteristics that must be sampled. Additional characteristics that are not specified in this document may be sampled "for information only." Fabrication shall have the responsibility to ensure that adequate tests and inspections are performed, at the vendor and/or after receipt inspection. TTQP-2-014 lists the inspections and tests that will be performed and the responsible organizations.

This document establishes guidelines for developing statistical sampling requirements for verifying TPBAR and TPBAR component design characteristics. The standards for implementation of these statistical sampling requirements are set forth in ANSI/ASQC Z1.4-1993 (Sampling Procedures and Tables for Inspection by Attributes), ANSI/ASQC Z1.9-1993 (Sampling Procedures and Tables for Inspection by Variables), and ANSI/ASQC Q3-1988 (Sampling Procedures and Tables for Inspection of Isolated Lots by Attributes). These references provide the methodology for statistical sampling and acceptance/rejection of product as a function of the following criteria:

- Limiting Quality Level (LQL), which is the percentage of variant (defective) units in a batch or lot.

- Probability of Acceptance (P_a), which is the probability that a lot will be accepted under a given sampling plan. The probability of acceptance is a function of the LQL.

The above ANSI references contain plots of P_a versus LQL. The assigned values of 100 - P_a(LQL) and 100 - LQL corresponding to the importance factors are tabulated in Table 2.

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Table 2. Default Sampling Guidelines

IMPORTANCE FACTOR	100 - P_a(LQL)	100 - LQL
Category A	95	95
Category B	95	95
Category C	95	90
Category D	95	75
Category E	95	75

The use of Table 2 may be illustrated by the following example. For Category D, there is a 95% probability that a lot containing 75% or less acceptable items will be rejected. (Or in other words, for a lot containing 25% or greater unacceptable items, the probability the lot will be accepted is 5%.)

The sampling guidelines identified in Table 2 are default guidelines. However, for certain component characteristics, the default sampling guidelines are not appropriate. Some of the tests being required follow recommended ASTM/ASME standards; therefore, a lower number of inspections or tests can be administered than specified in the default guidelines. In these instances, a "lot qualification" is more appropriate than statistical sampling. Also, the default sampling guidelines are not intended to apply to design characteristics that are verified through either destructive examinations or established through process parameter controls or special processes.

The long term optimization of design parameters and related fabrication processes requires a quantitative knowledge of the relationship between the statistical process capability span and the specified product tolerance for the various specified characteristics. For this reason, the inspection density may be higher initially than required by the statistical guidelines set forth above and may be expected to change over the course of time.

A matrix has been developed that lists the TPBAR components, their characteristics, importance factors, justification for these importance factors, and their safety significance. The safety significance and the justification is based on the logic described in the Failure Modes Effect

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Analysis that was developed for the TPBARs[b]. It is noted in parentheses when a characteristic will not be verified according to the default sampling guidelines (lot qualification, destructive test, etc.) In these instances, the sampling plan followed may be found in the applicable specification. Endnotes give the justification for the deviation from Table 2.

The matrix is divided by components at various stages of manufacturing. It may be assumed that the importance factor for a component is the highest importance factor of its characteristics (including feed stock materials). Table 3 lists the components and their overall importance factors. Table 4 lists the component characteristics and their importance factors.

Table 3. Importance Factors By Component

Component	Specification	Importance Factor
LTA Coated Stainless Steel Tubing	PNNL-TTQP-1-1007	Category B
Top and Bottom End Plugs	TTQP-1-014	Category B
Nickel Plated Getter Tube	PNNL-TTQP-1-1006	Category B
Nickel Plated Getter Disk	PNNL-TTQP-1-1006	Category C
Lithium Aluminate Pellet/Stack	TTQP-1-009	Category A
Liner	TTQP-1-010	Category C
Compression Spring	TTQP-1-013	Category C

[b]Smoter, RL. 1997. TPBAR LTA Failure Modes and Effects Analysis. Pacific Northwest National Laboratory. Richland, Washington

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Table 4. Importance Factors by Component Characteristics[c]

COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
LTA STAINLESS STEEL BAR STOCK (FOR CLADDING AND END PLUG BAR REDUCTION)[1]	Chemical Composition[2] Inclusions[2]	Category C	The failure of this characteristic to meet specifications could increase costs.

[c]The "safety related" column has been deleted in this revision.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
LTA SEAMLESS 316 STAINLESS STEEL CLADDING TUBE	Tensile Properties (lot qualification)[3] Intergranular Attack (lot qual.)[3] Wall Thickness Cladding Flaws	Category B	The failure of these characteristics to meet specifications could result in a cladding breach and tritium release. & location of absorber
	Chemical Composition (lot qual.)[3] Inclusions[4]	Category C	The failure of these characteristics to meet specifications could increase costs.
	Hardness (lot qual.)[3] Dimensions of OD and ID Circularity or Ovality Straightness	Category D	The failure of these characteristics to meet specifications would not cause the cladding to breach or significantly increase tritium permeation, although fabricability would be impacted.
	Carbide Precipitation (lot qual.)[3] Grain Size (lot qual.)[3] Residual Halides (lot qual.)[3] Surface Roughness Surface Condition Surface Cleanliness End Configuration	Category E	The failure of these characteristics to meet specifications would not cause the cladding to breach or significantly increase tritium permeation, or significantly impact cost or schedule.

COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
LTA COATED STAINLESS STEEL TUBING	Apparent Aluminide Thickness Aluminide Integrity (batch qual.)[5] Intermetallic Phases	Category B	The failure of these characteristics to meet specifications could allow tritium to permeate the cladding in excess of the design limits.
	Circularity or Ovality	Category B	An oval tube accelerates creep collapse, increasing potential for cladding failure and tritium release.
	Straightness	Category C	A non-uniform tube could become lodged in a fuel assembly and significantly impact costs to the utility.
	Dimensions of OD and ID	OD: Category C ID: Category D	The OD could cause the TPBAR to become lodged in a fuel assembly if it is too large. The ID would affect fabricability if it is out of spec.
	Outer Surface Condition Residual Halides on Outer Surface (batch qual.)[6]	Category E	The failure of these characteristics to meet specifications would not cause the cladding to breach or significantly increase tritium permeation, or significantly impact cost or schedule.
COATED STAINLESS STEEL TUBING END PREPARATION	Residual wall Thickness ID of Prep Zone Radial Depth of Aluminide Removed Residual Aluminide Content	Category B	The failure of these characteristics to meet specifications could cause rod failure and allow tritium to be released in excess of the design limits. & location of absorber
	Axial Depth of Aluminide Removed Perpendicularity of Tube Ends Trimmed Length Machined Surface Condition	Category D	The failure of these characteristics to meet specifications would not cause the cladding to breach or significantly increase tritium permeation, although fabricability would be impacted.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
END PLUG BAR STOCK	Volumetric Integrity End Defects	Category B	The failure of this characteristic to meet specifications could cause tritium to be released through the end plugs in excess of the design limits.
	Chemical Composition (lot qual.)[7]	Category C	Important to component function. The failure of this characteristic to meet specifications would not lead to increased tritium release.
	Dimensions of Bar OD	Category D	The failure of this characteristic to meet specifications would not cause the end plug to breach or significantly increase tritium permeation, although fabricability would be impacted.
	Intergranular Corrosion Susceptibility (lot qual.)[8] Surface Condition Surface Roughness Surface Marring Grain Size (lot qual.)[9] Carbide Precipitation (lot qual.)[9] Mechanical Properties (lot qual.)[7] Surface Cleanliness Inclusions[4]	Category E	The failure of these characteristics to meet specifications would not significantly increase tritium permeation, or significantly impact cost or schedule.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
TOP AND BOTTOM END PLUGS	Dimensions	Category C	The failure of this characteristic to meet specifications could increase costs (stuck rod).
	Surface Roughness Surface Defects	Category D	The failure of these characteristics to meet specifications would not significantly increase tritium permeation, although fabricability could be impacted.
	Surface Cleanliness Residual Halides (lot qual.)[10]	Category E	The failure of these characteristics to meet specifications would not significantly increase tritium permeation, or significantly impact cost or schedule.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
GETTER TUBE (UNPLATED)	Thickness[11]	Category B	The failure of this characteristic to meet specifications could allow tritium to be released in excess of the design limits.
	Chemical Composition (lot qual.)[12]	Category C	Important to getter function. The failure of this characteristic to meet specifications would not increase the tritium release rate because the gettering rate is not highly sensitive to the Zircaloy composition.
	Straightness	Category D	The failure of this characteristic to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, although fabricability would be impacted.
	Length Surface Finish Tube End Perpendicularity Oxygen, Hydrogen, Nitrogen Concentration (lot qual.)[12] Grain Size (lot qual.)[13] Surface Defects[14]	Category E	The failure of these characteristics to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, or significantly impact cost or schedule.

COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
NICKEL PLATED GETTER TUBE	Ni Thickness (destructive on ID, lot qual. on ID)[15] Ni Adhesion (destructive, lot qual.)[15] Trimmed Length Ni Plating Coverage (destructive on ID, lot qual. on ID)[15] Etched Weight (destructive, lot qual.)[15]	Category B	The failure of these characteristics to meet specifications could impact the gettering rate and cause tritium release to the coolant in excess of the design parameters.
	Dimensions of OD and ID	Category D	The failure of these characteristics to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, although fabricability would be impacted.
	Ni Purity (destructive, lot qual.)[15]	Category E	The failure of this characteristic to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, or significantly impact cost or schedule.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
GETTER DISK	Chemical Composition (lot qual.)[16]	Category C	Important to getter disk function. The failure of this characteristic to meet specifications would not increase the tritium release rate because the gettering rate is not highly sensitive to the Zircaloy composition.
	Surface Finish Disk Diameter Disk Thickness Oxygen, Hydrogen, Nitrogen Concentration (lot qual.)[16] Disk Flatness	Category E	The failure of these characteristics to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, or significantly impact cost or schedule.
NICKEL PLATED GETTER DISK UPPER & LOWER	Dimensions of Disk OD Thickness	Category D	The failure of these characteristics to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, although fabricability would be impacted.
	Ni Thickness Ni Adhesion (destructive, lot qual.)[15] Ni Plating Coverage Ni Purity (destructive, lot qual.)[15]	Category E	The failure of these characteristics to meet specifications would not measurably decrease the gettering rate or increase tritium permeation, or significantly impact cost or schedule.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
LITHIUM ALUMINATE PELLET/STACK	Li-6 Weight per Unit Length Lithium Assay Li-6 Isotopic Ratio Stack Length Stack Weight	Category A	The Li-6 weight per unit length is a calculated quantity that is based upon several parameters, which are listed here. An improper Li-6/inch loading in multiple TPBARs could affect the ability of the TPBARs to perform their safety function.
	Moisture Content[17]	Category B	The failure of this characteristic to meet specifications could cause getter loading and incremental increase of tritium release to the coolant.
	Impurity Chemistry	Category C	Important to pellet function. The failure of this characteristic to meet specifications would not increase tritium permeation.
	Concentricity of ID and OD Li/Al Ratio or aluminum assay Bulk Density Pellet Dimensions of OD and ID	Category D	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, although fabricability could be impacted.
	Equivalent Boron Concentration of Impurities Grain Size Dimensional Stability Perpendicularity Surface Condition	Category E	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, or significantly impact cost or schedule.

COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
LINER	Chemical Composition[18]	Category C	Important to liner function. The failure of this characteristic to meet specifications would not increase the tritium release rate because the gettering rate is not highly sensitive to the Zircaloy composition.
	Dimensions of Flange OD and Bend Radius Dimensions of Tube OD and ID Length Straightness Flanged End Perpendicularity	Category D	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, although fabricability would be impacted.
	Oxygen, Hydrogen, and Nitrogen Concentration (lot qual.)[19] Surface Defects	Category E	The failure of this characteristic to meet specifications would not measurably increase tritium permeation, or significantly impact cost or schedule.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
COMPRESSION SPRING	Chemical Composition[20]	Category C	Important to spring function. The failure of this characteristic to meet specifications would not increase the tritium release rate because the spring is not related to tritium permeation.
	Dimensions of Spring OD and Free Length Load at Compressed Length Spring Rate Cleanliness	Category E	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, or significantly impact cost or schedule.
GETTER PENCIL ASSEMBLY	Dimension from Coined Getter to Top of Pellet Straightness Outer Surface After Coining	Category D	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, although fabricability would be impacted. (Note that the pellet to pellet gaps are tested later in the target rod assembly.)
PLENUM GETTER AND DISK SUBASSEMBLY	Spot Weld Integrity Surface Condition Straightness Dimension of Coined Rim for both Pencil and Plenum Dimension of OD for both Pencil and Plenum Coined Length for both Pencil and Plenum Tube	Category D	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, although fabricability would be impacted.

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COMPONENT	CHARACTERISTICS	IMPORTANCE FACTOR	JUSTIFICATION
TARGET ROD ASSEMBLY	Pellet Placement	Category A	The failure of this characteristic to meet specifications could affect the ability of TPBARs to perform their safety function if multiple TPBARs were affected.
	Pellet to Pellet Gaps Pencil Orientation	Category B	The failure of these characteristics to meet specifications could cause small power peaking if the axial gaps between components were too large.
	Closure Weld Penetration Closure Weld Integrity[21] Closure Weld Surface Appearance Residual Halides on Outer Surface	Category B	The failure of these characteristics to meet specifications could cause a release of tritium to the coolant. Weld failure may result in local power changes only. Excessive residual halides could impact other reactor components.
	Top End Plug Perpendicularity Closure Weld Overhang Straightness Surface Cleanliness	Category C	The failure of these characteristics to meet specifications could increase costs, primarily through a stuck TPBAR.
	Length Outer Surface Condition Exclusive of Weld He Fill Gas Purity[22]	Category D	The failure of these characteristics to meet specifications would not measurably increase tritium permeation, although fabricability would be impacted.
	He Back Fill Pressure	Category E	The failure of this characteristic to meet specifications would not measurably increase tritium permeation, or significantly impact cost or schedule.

Notes

1. The cladding tubes and end plugs were manufactured from the same stock material. However, the diameter of this stock was reduced prior to manufacture of the end plugs. This reduced "end plug bar stock" is treated separately in this document.

2. The chemical composition and inclusions are tested per an approved material reverification plan.

3. Sampling plans of components that are established by lot qualification are generally material orientated characteristics, i.e. grain size, chemical composition, tensile properties, etc. They are uniform for the entire lot. Sampling plans for characteristics believed to be especially critical to performance, e.g. defect inspection, may be performed with up to 100% inspection.

   This methodology was developed and refined by Westinghouse Hanford Company over a period of ten years during their development of core component procurement programs for the FFTF reactor. The sampling plan used in TTQP-1-003 "Specification For Stainless Steel cladding Tubes" was taken form WHC's cladding tube specifications HEDL-S-0020 (1981) "Austenitic Stainless Steel Tubing For Breeder Reactor Core Component" and HS-V-P-04046 (1992) "Stainless & Heat-Resisting Tubes for Use in FFTF."

4. Measured on starting material.

5. "Integrity" is shorthand for several characteristics that are classified. See PNNL-TTQP-1-1007 for more information.

6. This characteristic is sampled lower than the default sampling plan because it is tested later on the final TPBAR assembly.

7. The sampling plan follows ASTM A-831/A-831-M

8. This test may be viewed as an overcheck of the carbide precipitation test. Sampling is based on the uniformity of a finished bar from a lot.

9. The sampling plan follows HWS-1946 Rev. 0.

10. The number selected per batch must allow sufficient surface area for testing.

11. The thickness is calculated based on measurements of the tube OD and ID.

12. The sampling plan follows ASTM B-353-91.

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13. Lot qualification adequate because the grain size will not change appreciably between lots.

14. Visual inspection.

15. Because this test is destructive to the specimen, only one sample per lot is tested for this property.

16. The sampling plan follows ASTM B-352-92.

17. Controlled by process parameters.

18. Based on tube hollow material certification, per ASTM B-353-91.

19. The number sampled per lot reflects the uniformity of oxygen, hydrogen, and nitrogen concentrations in the final lot.

20. Based on spring wire material certification.

21. Special process controls.

22. Certified by vendor.

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Battelle
Putting Technology To Work

Project No. 24895

Internal Distribution

JS Chardos (TVA)
JB Colson
JL Ethridge
RO Gates
RJ Guenther
BD Reid
RL Smoter
LA Strope
File/LB

Date July 1, 1997

To GC Sorensen

From DL Rittenhouse

Subject ASME Code Review for the LTA TPBAR

Task 1 has completed a review of ASME Boiler and Pressure Vessel (B&PV) Code requirements as they apply to the Lead Test Assembly (LTA) Tritium Producing Burnable Absorber Rod (TPBAR). Task 1 has applied the use of ASME B&PV Code methodology for the relevant design calculations and design specifications. The LTA TPBAR is in compliance with the intent of the applicable sections of the ASME B&PV Code 1989 and 1995 editions.

The structural members of the LTA TPBAR are designed in accordance with applicable stress and fatigue criteria equivalent to Section III of the ASME B&PV Code Subsection NG. The stresses applied to the structural members under the specified design operating conditions have margin to the Article NG-3000 limits with the exception of both the large break LOCA and the external pressure limits of NG-3133.

The specification for TPBAR end plug welding utilizes criteria that are equivalent to or exceed the applicable requirements of Section IX of the ASME B&PV Code Part QW and Section III, Article NG-5000. The LTA TPBAR end plug welding specification contains requirements and criteria for: the qualification of welds, welding operators, the procedures that will be employed, welding equipment, examination and inspection requirements, testing, nondestructive examination, destructive testing, essential variables, and records. The LTA TPBAR end plug weld examinations include: radiographic, visual, dimensional, metallographic and Helium leak testing. These examinations, in conjunction with the LTA TPBAR welding qualification program, will be utilized to prove the ability of the LTA TPBAR welding operators to make sound welds.

If you have any questions on this submittal, they may be directed to myself at (509) 372-6227 or Mr. Rob Gates at (509)-372-4090.

Prepared by:

RO Gates
Senior Research Engineer, TTQP

Reviewed by:

BD Reid
Lead Design Engineer, TTQP

FSAR SECTION 4.2 - BURNABLE ABSORBER RODS

Current FSAR Wording

- The burnable absorber rod clad is designed as a Class I component under Article NB-3000 of the ASME Boiler and Pressure Vessel Code, Section III, 1973 for Conditions I and II. For abnormal loads during Conditions III and IV, code stresses are not considered limiting. Failures of the burnable absorber rods during these conditions must not interfere with reactor shutdown or emergency cooling of the fuel rods.

Proposed FSAR Wording

- The burnable absorber rod clad is designed using subsections NB and NG of the ASME Boiler and Pressure Vessel Code, Section III, _____ as a general guide for Conditions I and II. For abnormal loads during Conditions III and IV Code stresses are not considered limiting. Failures of the burnable rods during these conditions must not interfere with reactor shutdown or emergency cooling of the fuel rods.

Westinghouse Electric Corporation
Energy Systems
Box 355
Pittsburgh Pennsylvania 15230-0355

June 30, 1997

97TV-G-0041

Mr. J. F. Burrow, Manager
PWR Fuel Engineering
Tennessee Valley Authority
1101 Market Street
BR 6A
Chattanooga, Tennessee 37402-2801

Dear Mr. Burrow:

TENNESSEE VALLEY AUTHORITY
TRITIUM TARGET QUALIFICATION PROJECT
TVA CONTRACT 94NNX-112361-001, MODULE 3.19
WATTS BAR CYCLE 2 MODEL COMPARISON W/ AND W/O TPBAR ASSEMBLIES

As part of the reload design analysis, a comparison between two Watts Bar Cycle 2 ANC models was performed. One model contained four tritium producing LTA's with eight TPBARs on each assembly. In the second model, the four tritium producing LTA's were replaced by WABA assemblies.

In light of recent concerns expressed by the NRC regarding the impact of the TPBARs on the reload design analysis, it is believed that a review of this analysis may address many of their concerns. A copy of the analysis is attached for your information and use. While the present core loading patterns have been modified slightly from those used for this analysis, we can confidently state that the results are essentially the same.

A summary of these results will also be included in the Tritium Target LTA Evaluation Report. Please let me know if you have any questions regarding this information.

Sincerely,

Jeffrey L. Slater
Project Engineer
ESBU Commercial Operations

JLS/sh

Attachment

cc:	J. F. Lemons	TVA Chattanooga	1A
	J. S. Chardos	TVA Bellefonte	1A
	S. F. Tanner	TVA Bellefonte	1A
	L. R. Evans	W Chattanooga Sales	1A

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