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

January 24, 1997

MEMORANDUM TO: David B. Matthews, Chief
Generic Issues and Environmental Projects Branch
Division of Reactor Program Management, NRR

FROM: James H. Wilson, Senior Project Manager
Generic Issues and Environmental Projects Branch
Division of Reactor Program Management, NRR

SUBJECT: SUMMARY OF JANUARY 22, 1997, PUBLIC MEETING BETWEEN NRC STAFF AND DOE ON TRITIUM PRODUCING BURNABLE ABSORBER ROD (TPBAR) LEAD TEST ASSEMBLY (LTA) TOPICAL REPORT

On January 22, 1997, the staff held a public meeting with the Department of Energy (DOE) at NRC headquarters in Rockville, Maryland, to discuss DOE's proposed responses to staff requests for additional information (RAIs). The staff's RAIs were transmitted to DOE by letters dated January 3, and 13, 1997, and concerned DOE's TPBAR LTA topical report submitted by letter dated December 3, 1996. This topical report seeks to establish that use of a commercial light-water reactor (CLWR) to irradiate a limited number of TPBARs in LTAs does not raise generic issues involving an unreviewed safety question. A list of attendees and their affiliations is provided as Attachment 1. DOE's proposed responses to the staff's RAIs in individual technical areas are provided as Attachments 2, 3, 4, and 5, as discussed below.

Quality Assurance

DOE and its contractor, Pacific Northwest National Laboratory (PNNL), presented their proposed responses to the staff's RAIs, as indicated in Enclosure 2. The staff and DOE were not able to resolve fundamental questions regarding the safety classification for the TPBARs. DOE has taken the position that these components are classified as non safety-related. Staff action in this area requires determination of the safety function of these assemblies in order to establish the applicability of Appendix B and Part 21 requirements. DOE stated that it would document the requirements embodied in TVA's procurement documents to Westinghouse and Westinghouse's contractual documents to its suppliers to identify the standards to which the TPBARs are contracted and committed and to clarify the details of the TPBAR QA program in its formal responses to the RAIs.

Materials and Chemical Engineering

DOE and (PNNL) discussed the proposed responses to the staff's RAIs, as indicated in Enclosure 3. The staff requested that DOE provide additional information to justify its conclusion that SS 316 with 20% cold work will not crack under the conditions expected for TPBAR LTAs during irradiation. DOE committed to provide this additional information in its formal response to the RAIs.

Reactor Systems

DOE and its contractor, Pacific Northwest National Laboratory (PNNL) discussed the proposed responses to the staff's RAIs, as indicated in Enclosure 4. With regard to Reactor Systems Question 4, DOE committed to provide a discussion of the changes to the PHOENIX code that Westinghouse made to account for the presence of the TPBARs in the core. The staff indicated the need for benchmarking of the PHOENIX and VIPRE codes to validate the implementation and user application of changes. The staff committed to determine whether examples of the benchmarking of the VIPRE code, discussed in Reactor Systems Question 5, were readily available and to so advise DOE. The staff also raised two additional concerns regarding the potential for, and consequences of, misloading the LTAs into the core and how the presence of the TPBARs in the core may affect the analysis of ATWS events. DOE committed to consider these additional issues in its formal response to the RAIs.

Security

DOE's response to the staff's RAI in the area of security is provided as Enclosure 5. The staff stated that it is still considering the issue of which agency will conduct security facility approvals. The staff will contact DOE to discuss review and approval of facility security plans and subsequent inspections.

DOE closed the meeting by stating that responses to the staff's RAIs, including proposed text revisions to the topical report, will be submitted by February 7, 1997. DOE estimates that it will submit Revision 1 to the TPBAR LTA topical report on March 3, 1997, prior to its briefing of the ACRS full committee.

DOE stated that it has down-selected to one plant, Watts Bar, for the irradiation portion of the LTA phase of its CLWR program. DOE staff also stated that the request for proposal for the production phase of the CLWR program will be available January 28, 1997.

Project No. 691

Attachments: As stated

cc w/ attachments:
See next page

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LIST OF ATTENDEES AT MEETING WITH DOE HELD IN
ROCKVILLE, MD ON JANUARY 22, 1997

NAME	AFFILIATION
J. H. Wilson	NRC
L. Phillips	NRC
D. Terao	NRC
R. Gramm	NRC
H. Richings	NRC
C. Willis	NRC
K. Kavanagh	NRC
J. Davis	NRC
C. Carpenter	NRC
L. Campbell	NRC
R. Latta	NRC
L. Telford	NRC
T. Wilson	ORNL
M. Clausen	DOE
J. Ethridge	PNNL
G. Sorenson	PNNL
L. Erickson	PNNL
B. Reid	PNNL
S. Bales	PNNL
B. Schmitt	PNNL
R. Latorre	PNNL
R. Smoter	PNNL
E. Lowe	PNNL
C. Harmon	SNL

Attachment 1

1. Provide a description of the components in the tritium-producing burnable absorber rod (TPBAR) lead test assemblies (LTAs) that are considered safety-related and a delineation of the portions of the TPBAR that receive PNNL's "Safety Class" QA program treatment.

Response:

The TPBAR LTAs do not perform a safety function and, consistent with the guidance of Regulatory Guide 1.26 and Regulatory Guide 1.29, could be considered non-safety related. Such a determination would be consistent with the Plant B utility's determination that the TPBAR is quality-related, but non-safety related per the requirements of their QA Program.

Objectives of the CLWR tritium target qualification program include demonstrating fabrication processes for the full production core and ensuring safe and reliable reactor operation. Accordingly, the design and fabrication of TPBARs is accomplished under the PNNL quality assurance program. The design and fabrication of the TPBAR LTAs are designated at the highest classification for activities under the PNNL quality assurance program. Individual components of TPBARs are not separately classified and the full PNNL quality assurance program applies to LTA TPBAR components.

2. Provide a description of how the relative safety-significance of components in the TPBAR is determined.

Response:

See response to Question 1.

3. Provide a consolidated description of the QA program controls that will govern design, fabrication, testing and installation of the LTAs. Specifically, this QA program description should contain a matrix that identifies conformance to each of the 18 Criteria of 10 CFR 50, Appendix B, as well as establishing the correlation with ASME NQA-I 1989.

Response:

As is common for nuclear sub-vendors, PNNL's quality assurance plan describing the QA program controls for design and fabrication of the TPBARs is available for inspection and NRC approval of the plan is not being requested. Qualification of PNNL as a component supplier, assembly of the LTAs, and installation into the host reactor will be performed under the host licensee's and Westinghouse's NRC-approved QA programs (see responses to Questions 4 and 14 below).

4. Define the contractual relationship among the participants identified in Figure 7-1 of PNNL-11419, including a detailed description of the programmatic controls and responsibilities related to 10 CFR Part 50, Appendix B, and 10 CFR Part 21.

Response:

Contracts were placed by Battelle, operator of Pacific Northwest National Laboratory (PNNL) with both the Tennessee Valley Authority and Georgia Power Company as candidates for the host utility to perform the LTA irradiation services, and Westinghouse Electric Corporation has existing nuclear component related contracts with each of the host utility candidates. PNNL has a separate contract with Westinghouse for the modification of the Westinghouse owned, and NRC approved computer code methodology that is needed to perform the necessary reload core design.

The host utility quality program and quality system requirements are being imposed on Westinghouse and PNNL and comply with 10 CFR 50, Appendix B. The final supplier of the completed LTAs to the host utility will be Westinghouse. As an approved supplier meeting utility quality requirements, Westinghouse provides QA oversight of PNNL in

accordance with their NRC-accepted 10 CFR 50, Appendix B program. Planned Westinghouse oversight activities include:

a) Performance of a supplier qualification audit to evaluate PNNL's compliance with 10 CFR 50, Appendix B and ASME NQA-1, Basic and Supplementary Requirements. (See response to item 17, below.)

b) Oversight of PNNL manufacturing operations and subcontractor control of quality.

c) Providing the utility a report summarizing the adequacy of PNNL's QA program, prior to insertion of the LTAs into the core.

The utility may conduct, in addition to Westinghouse oversight, effectiveness assessments of PNNL and PNNL's suppliers, utilizing a graded approach consistent with the importance, complexity and quantity of items and services procured. Assessments may consist of checks, reviews, verifications, examination, and witnessing of activities related to fabrication, testing, inspection and shipment of the LTAs. PNNL will furnish Westinghouse with certified subcomponents (TPBARs), and Westinghouse will complete the fabrication, certification, and delivery of the LTAs to the utility. Utility final acceptance of the LTAs will be based upon receipt inspection utilizing graded approach criteria contained in the utility's NRC-approved QA Program. Authorization to insert the LTAs into the core is contingent upon satisfactory results of these oversight activities.

PNNL also utilizes an LTA project-specific plan for the reporting of defects and noncompliances in response to 10 CFR Part 21.

5. Information contained in non-mandatory guidance sections (Appendices 2A1, 2A-2, 2A-3, 3A-1, 4A-1, 7A-1, 17A-1, and 18A-1) of NQA-1, 1989, specify information that is typically found necessary by the staff to implement the programmatic requirements of 10 CFR 50, Appendix B. Provide a copy of the current PNNL QA program that implements NQA-1 and describe how the PNNL quality assurance program implements those provisions.

Response:

The project QA plan, in combination with PNNL-wide and/or project-specific procedures, implements applicable portions of non-mandatory guidance of NQA-1

Appendices 2A-1, 2A-2, 2A-3, 3A-1, 4A-1, 7A-1, 17A-1 and 18A-1. (Also see response to Question 3.)

6. Describe the PNNL Regulatory Compliance and QA program to provide audit/oversight of component and service suppliers utilized by PNNL Design and PNNL Fabrication.

Response:

The project QA plan specifies that component and service suppliers are subject to PNNL QA oversight. This oversight includes: pre-award surveys, periodic audits, source inspections, in-process monitoring, and receipt inspection of delivered product.

7. Describe what quality provisions from the PNNL QA program are passed on to component and service suppliers utilized by PNNL Design and PNNL Fabrication. Also describe how PNNL determines the acceptability of the suppliers.

Response:

Procurements for design and fabrication require supplier implementation of a QA program that meets applicable portions of NQA-1, Basic and Supplementary requirements. Supplier acceptability is established based upon pre-award surveys, periodic audits, source inspections, in-process monitoring, and receipt inspection of delivered product.

8. If PNNL receives commercial grade items that are not manufactured in accordance with Appendix B QA requirements or the PNNL QA program for use in the TPBARS, describe the process employed by PNNL to determine the acceptability of those items (i.e. commercial grade item dedication).

Response:

No procured items for the TPBAR LTAs meet the NQA-1 or NCIG-07 definitions of commercial grade. PNNL will ensure that failures to comply are identified and corrected and that items are acceptable by appropriate combinations of testing, source inspection, review of supplier quality control plans, review of supplier documentation, and receipt inspection. Methods used will be appropriate to the characteristics to be verified.

9. Describe the management assessments and QA audits performed by PNNL Regulatory Compliance and QA to verify the effectiveness of the PNNL QA program implementation.

Response:

The project QA plan establishes requirements for periodic audits and management assessments. To date, PNNL has conducted four management assessments of QA plan implementation in the areas of: overall program adequacy and implementation, training, records, and design. No fabrication activities have commenced, so no assessments have been performed on such activities. Additional management assessments and at least one PNNL QA audit will be performed during 1997 to assess compliance with 10 CFR 50, Appendix B and NQA-1.

10. Provide a description of the PNNL verification processes that will be employed to assure that TPBARs conform to design specification requirements.

Response:

The project QA plan establishes requirements for source inspections, receipt inspections, review of supplier documentation, in-process and final acceptance inspections. The in-process and final acceptance inspections will be performed in accordance with written procedures. In addition, they will be specified in a Manufacturing And Quality Plan (MAQP) which will be reviewed and approved by Westinghouse.

11. Describe how design information will be controlled and transmitted across the interfaces between PNNL, Westinghouse, host utility organizations, and design services suppliers.

Response:

The control of design information within each organization is established by procedures in accordance with each organization's quality program. Transmittal of information between utility, Westinghouse and PNNL organizations is via designated organizational points of contact.

12. Describe the methods that will be used by host utilities to provide QA oversight of PNNL, Westinghouse, and sub-suppliers. Will Appendix B audits, surveillances, inspections be conducted by the host utility?

Response:

See response to Question 4.

13. A limited number of licensees have committed to NQA-1. Describe how host utility quality requirements (typically conform to NRC Regulatory Guides and endorsed ANSI N45.2 series standards) were transmitted to Westinghouse and PNNL and the method whereby the PNNL quality program was found acceptable by the host licensees.

Response:

See response to Questions 4 and 17.

14. Identify the Westinghouse quality program (such as the NRC-approved Quality Management System) that will be applied to activities associated with the LTAs.

Response:

Westinghouse will apply their NRC-approved Quality Management System (QMS) and implementing procedures to Westinghouse activities associated with the LTAs, including QA oversight. The Westinghouse QMS, Rev. 1 was approved by NRC letter from Quality Assurance and Maintenance Branch, Division of Reactor Controls and Human factors, Office of Nuclear Reactor Regulation, dated February 23, 1996.

15. Describe which organization is responsible for the LTA/TPBAR design. Discuss how design reviews and design verification will be carried out by this organization.

Response:

The design of the TPBARs is the responsibility of PNNL. This responsibility includes not only the design of the TPBARS to make tritium, but also the responsibility to

consider the implications to safety when the LTAs are loaded into a reactor core. Tritium release levels are also considered relative to the limits identified in 10 CFR. Project procedures control documentation and independent review of analyses and calculations by the PNNL design team. In addition, a series of design reviews by independent design review boards has been initiated in accordance with a project design review plan. The design review plan includes phased reviews by personnel with appropriate experience and expertise. Utility, Westinghouse and other personnel familiar with commercial reactor design, operation and regulation participated in the most recent design review held in December 1996.

As fuel supplier to the host plants, Westinghouse will provide a reload evaluation to the host utility that documents their evaluation of the acceptability of the TPBAR design relative to plant operation under the facility operating license.

16. Discuss how nonconforming conditions will be reported by supplier organizations to client organizations. Discuss how the client organizations will evaluate those nonconforming conditions.

Response:

PNNL addresses the reporting of nonconforming conditions through a formal mechanism established in the PNNL procurement quality system. PNNL procurement documents require that a supplier submit a "Contractor Nonconformance Request" (CNR) documenting any nonconforming condition tendered for acceptance of a variance from PNNL specifications. The supplier must describe the deficient condition, recommend a disposition and provide a justification. The supplier must submit the CNR for PNNL's review and approval. The recommended supplier disposition may be approved, modified or disapproved by PNNL and PNNL must provide an appropriate technical justification to support the disposition. During the review of the CNR, PNNL will make a determination regarding the type of verifications that are necessary to assure that CNR disposition has been completed correctly.

LTA-related nonconformance reports, whether generated by PNNL or a PNNL supplier will be made available to Westinghouse and the host utility as part of the process. The host utility reserves the right to review and concur in all repair and use-as-is dispositions of nonconformances with the utility requirements.

17. Describe the process whereby Westinghouse qualified PNNL as an approved supplier for LTA design and fabrication.

Response:

Westinghouse performed a qualification audit of PNNL in accordance with the NRC-approved Westinghouse Quality Management System (QMS) (see response to Question 14). The scope of this audit included verifying PNNL's compliance with 10 CFR 50, Appendix B and ASME NQA-1, Basic and Supplementary Requirements. As a result of the audit, Westinghouse placed PNNL on the Westinghouse Qualified Supplier List. The listing on the Westinghouse Qualified Supplier List is conditional upon: 1) satisfactory corrective action response to identified audit findings; and 2) a follow-up audit to verify PNNL QA program implementation in the manufacturing area. (No fabrication had occurred at the time of the audit.) Upon satisfactory implementation of corrective actions and closure of any findings resulting from follow-up audits, Westinghouse will update the status of PNNL to "approved."

18. Describe the process employed by Westinghouse to provide QA oversight of PNNL and sub-suppliers. Will Appendix B audits and inspections be utilized?

Response:

See response to Question 4.

19. Describe the processes that will be utilized by Westinghouse (eg. receipt inspection, dimensional and configuration verification, and material verification) to verify TPBARs conform to Westinghouse technical requirements prior to assembly in LTAs.

Response:

See response to Question 4. In addition to the activities described in response to Question 4, Westinghouse will review PNNL supporting documentation certifying the TPBAR was built in accordance with the design and quality requirements, provides unique identification for traceability, and performs receipt inspection in accordance with approved pro[illegible]res.

20. Describe the processes that will be utilized by host facilities (eg. receipt inspection, dimensional and

configuration verification, and material verification) to confirm that LTAs are suitable for installation in the core.

Response:

See response to Question 4 and PNNL-11419, Section 6.2.

21. Describe whether Westinghouse special processes (eg. welding) have been re-qualified as necessary to account for differences in TPBAR material from that typically used in LTA assemblies.

Response:

Special process procedures (including welding) will be developed and qualified by PNNL and are, therefore, not considered to be re-qualified Westinghouse special processes. The special process controls, however, will be subject to oversight by Westinghouse and PNNL QA. Special processes will be identified and key parameters defined in a Manufacturing And Quality Plan (MAQP) which is subject to review and approval by Westinghouse.

1) Section 1 - The design life for the assembly is 550 EFPD. What were the fluence levels used to establish the design life? Also, does the design take into account possible power uprate or extended cycles?

Response:

The neutron fluence values used in the design of TPBARs are identified in Table 2-5 of the Topical Report. The TPBAR was not specifically designed to take into account possible power uprates or extended operating cycles. Neither Plant A nor Plant B plan to implement a power uprate or extended cycle for the period of LTA irradiation.

2) Section 1.1 - "The TPBAR design has been developed to demonstrate... tritium leakage consistent with a TPBAR design goal of <6.7 Ci per rod per year...." This appears to imply that for full operation, the reference plant will be leaking thousands of curies of tritium per year of operation.

Response:

The design goal for TPBAR tritium leakage to the RCS for a full production core is less than 20,000 curies per year. Assuming approximately 3000 TPBARs in a production core, this equates to the <6.7 curies per rod per year used for evaluation of the LTAs. (The acceptability of the design level of leakage for the production core will be evaluated as part of the license application to support production.) Note that, although the design goal is *less than* 6.7 Ci per rod per year, dose calculations in Chapter 6 of PNNL-11419 (and in response to Reactor Systems' requests for additional information, item 7) are conservatively based on 6.7 Ci per rod per year.

3) Sections 2.2.1 & 5.3.1 - Why was 316 SS with 20% CW selected as the material for cladding and end plugs? Were higher strength, corrosion resistant alloys (e.g., Alloy 690, Inconel 718, Zircaloy-4) considered?

Response:

The LTA TPBAR is an evolutionary target design and 300-series SS has been the material historically used for tritium target cladding. The processes for permeation barrier application were developed using 300-series SS cladding. Sufficient experimental and performance data for barrier-coated tubing using other materials is not available. 316 SS

with 20% CW was specified to maximize strength while staying within the experience base established for 300-series SS.

4) Section 2.2.4 - What is the basis for selecting 302 SS for the plenum spring material?

Response:

302 SS was selected for the TPBAR plenum spring since this material has been successfully used in burnable poison rod and fuel rod plenum spring applications in Westinghouse reactors. An analysis of the TPBAR plenum spring demonstrates that spring stresses are well within allowable stresses for this material during worst-case combinations of preload, manufacturing tolerances, pressure conditions, and component thermal and radiation growth.

5) Section 2.4 - Provide additional details regarding the nondestructive testing. What techniques are used for each component? What are the applicable standards?

Response:

See Table 5.

TABLE 5
Nondestructive Testing Techniques and Applicable Standards for Acceptance of TPBAR and TPBAR Components

TPBAR Component	Method	Applicable Standard	Characteristic
Nondestructive Tests Performed by PNNL[1]			
Coated Cladding	Eddy Current		Coating thickness, uniformity of thickness along the tube, and inter-metallic phase
Final TPBAR Assembly	Radiography	NE F3-10 [2]	Welds, component placement
Final TPBAR Assembly	Helium Leak Test	ASME B&PV, Section V, Article 10	Rod cladding integrity (leak tightness)
Nondestructive Tests Performed by Subvendors			
316 SS Bar Stock	Ultrasonic	ASTM E213-93	Defects
316 SS Bar Stock	Liquid Penetrant	ASTM E165-95	End defects
Cladding tubing	Ultrasonic	ASTM E213-93	Wall thickness, flaws
Plated getters (tubes and disks	X-ray spectrometry	ASTM B568-91	plating thickness and coverage

NOTES:
[1] All personnel performing acceptance inspections will be certified to ASNT-TC-1A.
[2] DOE specification developed for fast breeder reactor program.

1) Table 2-5 - What Li enrichment was used to calculate the axial power? Many power and burnup-related parameters are well beyond the conditions sustained in prior tests. Viewed in this way, the TPBAR appears to be a large jump beyond prior experience.

Response:

The Tritium-Producing Burnable Absorber Rod (TPBAR) axial power is based upon the ^{6}Li enrichments listed in Table 2-5.

The tests performed in research reactors were accelerated tests at higher flux levels, which, with the display of data in Table 2-5, can give the illusion of a large jump from current experience when it is not. For example:

- TPBAR Effective Full Power Days (EFPD), which is a reactor-specific value dependent on the reactor's full power rating, increases by a factor of two or more over those of the listed test rods; whereas the predicted TPBAR thermal neutron fluence is clearly bounded by the listed tests.

- Rod average percent ^{6}Li burnup for the TPBARs is a factor of four greater than the listed tests; whereas a more appropriate parameter related to pellet stability would be total Li burnup which is directly related to Gas Volume Ratio (GVR)[1]. (Pellet GVR is analogous to fuel MWD/MTU.) In the case of GVR, Table 2-5 does not include all tests used as bases for TPBAR design; for example, test results shown in Table 2-6 are among those that provide an experience base for pellet behavior up to a GVR of 216, which bounds the design GVR for the TPBAR.

2) Section 3.1.1 - Are WIMS-E and MCNP codes qualified for NRC use? Are auditable calculation files available for review of inputs, assumptions, and other details of the calculations?

Response:

Neither of these two codes are qualified by NRC for use in safety calculations. The neutronic studies performed for this report using WIMS-E and MCNP were scoping calculations only, therefore no auditable calculations are available for review. The

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[1]Ratio of gas volume (at standard temperature and pressure) to pellet volume.

analyses of record will be performed by Westinghouse using an NRC-approved methodology (PHOENIX) and documented in auditable calculation files. As stated in Section 3.4, the excellent agreement found in comparisons between PNNL WIMS-E and PHOENIX-L establishes confidence that the Westinghouse calculations will provide predictions of the reload core comparable to those in the WIMS-E scoping calculations. Additional calculations required by Westinghouse or the licensee will be performed in a manner that meets Westinghouse QA requirements.

3) Section 3.1.1 - Provide an explanation for why the reactivity difference between MCNP and WIM-E of 0.5% appears high.

Response:

The 5 mK difference seen in the cross code comparison between WIMS-E and MCNP for a fuel assembly model containing TPBARs is considered quite good. The WIMS-E code is a deterministic, transport theory code and MCNP employs a statistical, Monte Carlo solution methodology. In addition, each code uses an independent set of nuclear cross section data libraries (European vs ENDF/B, respectively). In consideration of the substantial differences in calculation methodologies and the use of unrelated nuclear data libraries, some differences in calculated reactivity are to be expected, and in this case the difference is relatively small.

4) Section 3.4 - Will the differences between PHOENIX-L and PHOENIX-P be documented in a topical report?

Response

The differences between the two versions of the PHOENIX code will be documented in a Westinghouse report that will be provided to the host utility and PNNL. These differences will also be documented internally at Westinghouse in the computer software verification and validation documentation.

5) Section 4.1.2 - Is the VIPRE code NRC-qualified? Are auditable calculation files available for review of inputs, assumptions, and other details of the calculations?

Response:

The VIPRE code has been reviewed by NRC. A technical evaluation report (TER) was issued in 1994, ITS-NRC-93-1 "Technical Evaluation Report: VIPRE-01 Mod-02 for PWR and BWR Applications, EPRI-NP-2511-CCM-A, Revision 3". The application of the code for Plants A and B does not use plant-specific heat transfer or CHF correlations. The application uses only the well known Dittus-Boelter single phase heat transfer correlation, and the cylindrical heat conduction model (for heat conduction across a guide thimble wall, between the fuel channel and TPBAR channel). These are described in the TER. Flow is provided by the utility/Westinghouse, and is used as a boundary condition. The VIPRE code is not used to evaluate flow distribution or core pressure drop.

The calculations presented in the initial report were not final. Final calculations are planned to support Revision 1 to PNNL-11419. The final calculations will be documented in an auditable file.

6) Section 4.1.2 - The last paragraph suggests that the results in Figure 4-1 are preliminary and are more conservative than Westinghouse's normal method. Will a final T-H analysis be submitted or is the decision to be based on the results given? What assumptions are more conservative than normal?

Response:

The calculations were preliminary in that they were not documented in an auditable manner and the model did not include the guide thimble dashpot region. As discussed in response to item 5, final calculations are planned to support Revision 1 to PNNL-11419. PNNL does not expect significantly different results between the preliminary and final calculations. If further calculational results are more limiting than those documented in PNNL-11419, the host utility will be notified such that their safety evaluation adequately addresses the impacts.

For both Condition I and II events, the Westinghouse calculations for BP rods took credit for cladding superheat in evaluating (and preventing) the onset of subcooled nucleate

boiling. PNNL calculations do not take credit for cladding superheat, they apply the temperature limit to the bulk coolant.

Also, for Condition I and II events, the Westinghouse BP calculations used nominal inlet temperature, outlet pressure, and minimum flow (based on dimensional tolerances without an additional 5% flow maldistribution penalty). For Condition I, PNNL calcuations used the most limiting conditions as would be applied to LOCA and DNBR evaluations for inlet temperature, pressure, and flow maldistribution (this results in 5% more flow reduction than just for dimensional tolerances). For Condition II, PNNL calculations use similar assumptions as Westinghouse (nominal conditions, with dimensional tolerances accounted for).

7) Section 6.1 - Provide the value of the total off-site exposure and the regulatory limits, rather than stating that the increase due to TPBARs is small.

Response:

See the attached Tables 7-A and 7-B which summarize total exposures and regulatory guidelines/limits for Plants A and B. The total body dose was calculated using the following equation:

Total Body Dose = γ whole body dose + w_T*Thyroid dose + w_β*β dose

where w_T = Thyroid weighting factor from 10CFR20.1003 (= 0.03)
w_β = Beta skin dose weighting factor from ICRP Publication 60, *1990 Recommendations of the International Committee on Radiological Protection*, published by Pergamon Press (= 0.01)

8) Section 6.1 - Why is the release rate modeled as a constant? As pressure in the TPBAR increases, would the release rate not also increase? If a constant release rate is used as an approximation, it should be a conservative end-of-life number.

Response:

To evaluate this issue, calculations were performed using time-dependent release rates for the TPBARs. Using neutronic data for Plant B, the end-of-cycle tritium inventory increased over that calculated for a constant release rate. The peak tritium concentration

also increased, which results in an increase in the offsite dose during a SGTR (not reflected in Tables 7-A or 7-B). For the breached rod case, the end-of-cycle tritium inventory decreases compared to the constant release model. The breached rod case assumes all tritium is released to the coolant as it is produced and the production decreases over the cycle due to ^{6}Li depletion. Occupational doses will be impacted accordingly. The time-dependent release rate model will be used in classified calculations for the occupational dose data that will be presented in Revision 1 to the classified topical.

9) Section 6.2.2 - Does the plant loading and handling procedure account for the actual weight of BPRA? In particular, is there a load limit to prevent damage to the fuel assembly from withdrawing a stuck rod assembly? If so, does the procedure need to be modified to account for the lighter weight of the TPBAR?

Response:

The plant handling procedure for the burnable poison rod assembly (BPRA) handling tool contains a precaution stating that if significant resistance is felt during removal that the assembly is either fully withdrawn or stuck and visual verification of position must be made. The BPRAs are removed by a hand winch operated tool. There are no provisions for a load monitoring device to be attached to this tool. This tool is used to handle BPRAs containing as few as six full length pins to as many as 24 full length pins. The LTA weight is bounded by these conditions and no change to the procedure or handling equipment is warranted.

TABLE 7-A
Summary of Off-Site Radiological Consequences for the TPBARs in Plant A

Condition	Receptor	Current Total Body Dose (rem)	Total Body Dose with LTA (rem)	Increase w/ LTA	Reference Value / Source
Normal Operation	MEI[1]	0.000839	0.000840	0.074%	0.003 rem / 10CFR50, App. I
Cladding Breach	MEI	0.000839	0.000872	3.93%	0.003 rem / 10CFR50, App.I
Steam Generator Tube Rupture[2]	EAB[2]	0.0717	0.0717	3.4e-3%	2.5 rem / SRP 15.6.3
	LPZ[3] (8 h)	0.0307	0.0307	4.7e-3%	
Fuel Handling Accident (Containment)	EAB	0.0142	0.0142	none	
	LPZ (2 h)	0.0058	0.0058	none	
Fuel Handling Accident (Auxiliary Bldg)	EAB	2.4000	2.4000	none	
	LPZ (2 h)	0.9500	0.9500	none	
LOCA	EAB	3.1060	3.1060	4.0e-4%	25 rem / 10CFR100
	LPZ (30 d)	2.8120	2.8125	0.019%	

NOTES:

[1] Maximum Exposed Individual.

[2] Exclusion Area Boundary for 2 h = Fenceline Receptor

[3] Low Population Zone = MEI Receptor

TABLE 7-B
Summary of Off-Site Radiological Consequences for the TPBARs in Plant B

Condition	Receptor	Current Total Body Dose (rem)	Total Body Dose with LTA (rem)	Increase w/ LTA	Reference Value / Source
Normal Operation	MEI[1]	0.0007	0.0007002	0.029%	0.003 rem / 10CFR50, App. I
Cladding Breach	MEI	0.0007	0.000713	1.86%	0.003 rem / 10CFR50, App.I
Steam Generator Tube Rupture	EAB[2]	0.8625	0.8625	2.2e-4%	2.5 rem / SRP 15.6.3
	LPZ[3] (8 h)	0.2004	0.2004	2.2e-4%	
Fuel Handling Accident (Containment)	EAB	2.0075	2.0075	none	
	LPZ (2 h)	0.4663	0.4663	none	
Fuel Handling Accident (Auxiliary Bldg)	EAB	0.7815	0.7815	none	
	LPZ (2 h)	0.1815	0.1815	none	
LOCA	EAB	3.2874	3.2874	4.0e-4%	25 rem / 10CFR100
	LPZ (30 d)	2.0002	2.0007	0.027%	

NOTES:

(1) Maximum Exposed Individual.

(2) Exclusion Area Boundary for 2 h = Fenceline Receptor

(3) Low Population Zone = MEI Receptor

DRAFT RESPONSE TO NRC
REQUESTS FOR ADDITIONAL INFORMATION
DATED 1/3/97
Security

1) Section 8.3 - As indicated in the staff's letter dated November 1, 1996, the staff agrees that additional individual access authorization by NRC is not needed. However, the staff is still considering the issue of DOE conducting and granting security facility approvals at NRC licensee sites.

Response:

Section 8.3 of PNNL-11419 incorrectly characterized the staff's letter dated November 1, 1996 by stating that it confirmed that DOE requirements relative to security facility approval satisfy corresponding NRC requirements. PNNL-11419 will be revised to correctly indicate that no additional NRC action is required for personnel access authorizations relative to the CLWR tritium program and that security facility approval will be coordinated between DOE and NRC to meet applicable regulatory requirements.

Regardless of the approving agency, DOE (or its contractor) will review the host facility to ensure that it meets DOE requirements for safeguarding of DOE classified material prior to shipment of the material to the site.

Project No. 697
DOE Tritium Program

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