NRR-DMPSPEm Resource

From: Lamb, John
Sent: Monday, August 27, 2018 3:57 PM
To: rdwells0@tva.gov
Subject: RAI for Watts Bar Unit 2 TPBARs LAR and Watts Bar Units 1 and 2 LAR Related to Fuel Storage (EPID: L-2017-LLA-0427)

Importance: High

Mr. Wells:

By application dated December 20, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17354B282), as supplemented February 15, and April 9, 2018 (ADAMS Accession Nos. ML18047A181 and ML18100A953, respectively), Tennessee Valley Authority (TVA or the licensee) submitted a proposed license amendment request (LAR) to authorize up 1,792 tritium producing burnable absorber rods (TPBARs) that can be irradiated in the reactor for Watts Bae Nuclear Plant (WBN), Unit 2. In addition, the proposed LAR requests changes to WBN Unit 1 and 2 Technical Specifications (TSs) related to fuel storage.

The requested changes would revise WBN Unit 2 TS 4.2.1, "Fuel Assemblies," to authorize up to 1,792 Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated in the reactor.

Specifically, the requested changes revise WBN Units 1 and 2 TS 3.7.15, "Spent Fuel Assembly Storage," to simplify the fuel storage limitations on fuel assemblies by eliminating the burnup–related criteria. The requested changes add WBN Units 1 and 2 TS 3.7.18, "Fuel Storage Pool Boron Concentration," to specify the minimum fuel storage pool boron concentration when fuel is stored in the pool. The requested changes revise WBN Units 1 and 2 TS 3.9.9, "Spent Fuel Pool Boron Concentration," to modify the minimum fuel storage pool boron concentration during refueling operations when fuel is stored in the pool. The requested changes revise WBN Units 1 and 2 TS 4.3, "Fuel Storage," to replace the storage limitations on fuel assembly burnup and storage with a single requirement to maintain a specified boron concentration in the spent fuel pool (SFP). The requested changes add WBN Units 1 and 2 TS 5.7.2.21, "Spent Fuel Storage Rack Neutron Absorber Monitoring Program."

The NRC staff has reviewed TVA's submittal, as well as supplements, and determined that additional information is required to enable the U.S. Nuclear Regulatory Commission (NRC) staff to make an independent assessment regarding its technical review.

On August 13, 2018, the NRC staff held a clarifying call with TVA to ensure that TVA understood the questions. TVA stated that it would respond to the below RAIs within 45 days from date of the RAI email.

Thanks.
John

ENCLOSURE

<u>REQUEST FOR ADDITIONAL INFORMATION</u>

<u>RELATED TO TRITIUM PRODUCING BURNABLE ABSORBER RODS FOR WAATS BAR NUCLEAR PLANT, UNIT 2</u>

<u>AND FUEL STORAGE LICENSE AMENDMENTS REQUEST FOR WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2</u>

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-390 and 50-391

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ARCB-RAI-1

In the application on page E1-23 of 116 in the Primary and Secondary Coolant Concentrations section it states:

> The concentration of tritium for a TPC was calculated using the same methodology as used for WBN U1, which involved 1,792 TPBARs with a permeation rate of 5 Ci/TPBAR/year and two failures … The total annual tritium expected from TPBARs is based on 1792 TPBARs and a permeation rate of 5 Ci/TPBAR/year (8960 Ci/year). This results in an average tritium concentration of 11.4 μCi/gm. The concentration with 2 TPBAR failures was determined by adding the inventory of 2 TPBARs to the average amount of tritium in the RCS and dividing by the RCS mass. The average amount of tritium was determined by multiplying the average tritium concentration determined above by the RCS mass. Each TPBAR is assumed to have a maximum of 11,600 Ci at the end of a cycle. This resulted in an expected tritium concentration in the primary coolant of approximately 120 μCi/gm for 2 TPBAR failures.

In the application it is also states numerous times that this LAR is based on WBN unit 1 license amendment 40. However, WBN unit 1 license amendment 40 has been superseded by license amendment 107 and in supplement to the application dated March 31, 2016 (ADAMS Accession number ML16095A064) on page Enclosure 2, page 8 of 40, it states:

> **Non-LOCA Accident Source Term:** This source term is used for evaluation of abnormal operational occurrences (AOOs) and postulated accidents (PAs). It was updated to reflect a

new permeation rate of 10 Ci/TPBAR/year, which bounds the realistic permeation rate with 100% margin. It also has increased margin by assuming ~40% more TPBARs are loaded (i.e., 2,500 TPBARs). It continues to retain conservatism regarding the inclusion of two failed TPBARs. This bounding approach to source term assumptions for accidents is consistent with the accident evaluation methodology. The modified source term provides sufficient margin to bound AOO and PA cases.

Furthermore, Enclosure 2, page 37 of 40 states:

…the source term is the primary and secondary coolant activity. The primary and secondary coolant activities are in accordance with ANSI/ANS-18.1-1984, except for tritium. ... This source term was updated to reflect a new permeation rate of 10 Ci/TPBAR/year, which bounds the realistic permeation rate with 100% margin. It continues to retain conservatism regarding the inclusion of two failed TPBARs. …

WBN Unit 1 License Amendment 40 and the current licensing basis determined the expected tritium concentration assuming a permeation rate of 1 Ci/TPBAR/year, 2,304 total TPBARs, and two failed TPBARs. ... The assumed RCS tritium activity to support the requested changes is based on 2,500 TPBARs with an assumed permeation rate of 10 Ci/TPBAR/year and two failed TPBARs. This results in a concentration of 124.9 μCi/gm.

The design basis accident assumptions for WBN Unit 1 appears to be different from that stated for WBN Unit 2, and the NRC staff is unclear which one is being requested in this license amendment request.

Please clarify, for the DBAs that assume primary and secondary coolant concentrations as their source term, what reactor coolant system tritium concentration is assumed and what is it based on, such as a permeation rate, total TPBARs, and how many failed TPBARs.

ARCB-RAI-2

In the application on page E1-26 of 116 it states:

Table 4.1-6 and 4.1-7 contain a tabulation of common control room parameters and the atmospheric dispersion factors, respectively, used in each of the design basis analyses. These are the same parameters that supported the review for NUREG-0847 Supplement 25 except for the control room isolation time, which has been corrected to account for an error.

Table 4.1-7, Atmospheric Dispersion Factors states:

Time Period (hr)	EAB	LPZ	LOCA/FHA[1]	SGTR/MSLB/LOOP	WGDT/FHA[2]
0-2	6.382E-04	1.784E-04	1.09E-03	2.59E-03	2.56E-03
2-8	-	8.835E-05	9.44E-04	2.12E-03	-
8-24	-	6.217E-05	1.56E-04	-	-
24-96	-	2.900E-05	1.16E-04	-	-
96-720	-	9.811E-06	9.59E-05	-	-

1 - This is used for the Containment FHA [Fuel Handling Accident]

2 - This is used for the Containment FHA after containment is isolated and for the Auxiliary Building FHA

In NUREG-0847 Supplement 25 Tables 15.5 and 15.6 it states that the control room atmospheric dispersion factor for the FHA in closed containment, FHA inside open containment, and FHA in the Auxiliary Building for the time period 0 to 2 hours is 2.59E-3 seconds per cubic meter. This control room atmospheric dispersion factor is different from those stated in the license amendment request for the FHA.

Explain which control room atmospheric dispersion factor(s) for the FHA are being requested in this license amendment. If they differ from the current licensing basis as stated in Tables 15.5 and 15.6 of NUREG-0847 Supplement 25 then provide the technical basis for the change.

MCCB RAI #1:

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.68, "Criticality accident requirements," provides the regulatory requirements for maintaining sub-criticality in the spent fuel pool (SFP). Specifically, 10 CFR 50.68(b)(4) states that the k-effective in the SFP:

> …must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 confidence level, if flooded with unborated water.

In the proposed Technical Specification (TS) 5.7.2.21 "Spent Fuel Storage Rack Neutron Absorber Monitoring Program," the licensee states that the program will be used to verify the "…neutron absorber density is consistent with the assumptions in the spent fuel pool [SFP] criticality analysis." However, the Boron-10 (B-10) areal density (AD), is the main property of the neutron absorbing material (NAM) that needs to be verified with respect to the SFP criticality analysis, not the neutron absorber density. Explain why the density of the NAM is specifically cited in the proposed TS, instead of the B-10 AD, which is more important assumption used in the SFP criticality analysis.

DORL RAI #1

In the submittal dated December 20, 2017, Enclosure 6 contains a commitment to replace the Containment Isolation Thermal Relief Check Valves on the WBN Unit 2 supply lines to Containment for the Component Cooling Water (CCW) System and Essential Raw Cooling Water (ERCW) System with simple relief valves. TVA states that the simple relief valves will be installed prior to loading TPBARs in the WBN Unit 2 reactor core. The WBN Unit 2 Facility Operating License (FOL) NPF-96 expires October 21, 2055. There are numerous refueling outages (RFOs) between now and the end of the FOL. Has TVA scheduled a RFO to replace the Containment Isolation Thermal Relief Check Valves with simple relief valves? If so, which RFO is this work planned to be completed? If the valves are not replaced prior to the completion of this LAR, the NRC will add this as a license condition to FOL NPR-96.

DORL RAI #2

In the submittal dated December 20, 2017, TVA requests that the license amendment be implemented prior to startup from the outage where any number of TPBARs is inserted in the WBN Unit 2 reactor core. The WBN Unit 2 FOL expires October 21, 2055. There are numerous RFOs between now and the end of the FOL. Potentially, this amendment could be effective but remain not implemented for decades. Does TVA have a schedule to install TPBARs in WBN Unit 2? If so, which RFO is the TPBARs scheduled to be installed for WBN Unit 2? Are the WBN Unit 2 TPBARs scheduled to be installed during the Cycle 4 RFO in the fall of 2020? Is there a contingency plan if the TPBARs are not installed in WBN Unit 2 as planned that RFO? For example, if TVA plans to install TPBARs in WBN Unit 2 during the Cycle 4 RFO in the fall of 2020, but for some reason is not able to, what is TVA's contingency plan?

DORL RAI #3

What was the permeation rate for Cycle 13 of WBN Unit 1? What was the permeation rate of Cycle 14 of WBN Unit 1? What has TVA learned from the testing of the TPBARs from Cycles 13 and 14?

SNPB RAI #1

During the acceptance review of this LAR, NRC staff requested supplemental information and TVA responded on February 15, 2018 in a letter CNL-18-018. The supplemental information requested was to clarify the discrepancy between the fluence results from WCAP-18191-NP and WCAP-17035-NP for Watts Bar Unit 2 regarding the change reported inside surface neutron fluence for the RPV at 32 EFPY (1861 E+19 n/cm^2 from WCAP-18191-NP versus 3.17 E+19 n/cm^2 from WCAP-17035-NP). The TVA response provides a comparison of the power distribution of Cycle 7 in WCAP-18191 (low leakage pattern) and the radial power distribution used in WCAP-17035 (out-in pattern) in Tables 1 and 2. It was shown that the average of the relative power in the peripheral assemblies for low leakage pattern used in WCAP-18192 for Cycle 7 is 0.590 (Table 1) while the average of the relative power in the peripheral assemblies for out-in pattern used in WCAP-17035 is 0.97. However, a vast majority of the relative powers of the interior assemblies in Table 1 show increased relative powers compared to those listed in Table 2. Please provide an explanation for why the relative powers of the interior assemblies in Table 1 is greater than those of the Table 2.

SNPB RAI #2

It is stated in TVA response (CNL-18-018) that *the average peripheral power* increases the number of TPBARs. Also the maximum RPV flux increases from 1.351E10 n/cm^2-s to 1.687E10 n/cm2-s between Cycle 3 and Cycle 4. Furthermore, the maximum reactor pressure vessel (RPV) flux further increases in Cycle 5 to about 1.95E10 n/cm2-s through Cycle 7. While these increases in maximum RPV flux cannot be solely associated with the implementation of TPBARs, the anticipated loading patterns including TPBARs (Cycles 4 through7) will impart a greater maximum flux on the reactor vessel than Cycle 3 which does not include TPBARs.

(a) Please describe the factors that contribute to the increase in RPV flux as the number of TBBARs increase.

(b) Provide data on the flux values from both out-in pattern and low leakage patterns used in WCAP-18191 and WCAP-17035, respectively.

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Mail Envelope Properties (John.Lamb@nrc.gov20180827155700)

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Sensitivity: Normal
Expiration Date:
Recipients Received:

Time Period (hr)	EAB	LPZ	LOCA/FHA[1]	SGTR/MSLB/LOOP	WGDT/FHA[2]
0-2	6.382E-04	1.784E-04	1.09E-03	2.59E-03	2.56E-03
2-8	-	8.835E-05	9.44E-04	2.12E-03	-
8-24	-	6.217E-05	1.56E-04	-	-
24-96	-	2.900E-05	1.16E-04	-	-
96-720	-	9.811E-06	9.59E-05	-	-