



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-20-059

August 10, 2020

10 CFR 50.55a

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Browns Ferry Nuclear Plant, Units 1, 2, and 3 -- Response to Request for Additional Information Regarding Proposed Alternative Request No. 0-ISI-47 for the Third, Fifth, and Fourth 10-Year Inservice Inspection Intervals (EPID L-2020-LLR-0034)**

- References:
1. TVA Letter to NRC, CNL-20-019, "Browns Ferry Nuclear Plant, Units 1, 2, and 3, American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Inservice Inspection and Augmented Program Interval Request for Alternative 0-ISI-47," dated February 28, 2020 (ML20059N637)
 2. NRC Electronic Mail to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Request for Additional Information Regarding Alternative Request No. 0-ISI-47 (EPID L-2020-LLR-0034)," dated July 13, 2020 (ML20195B130)

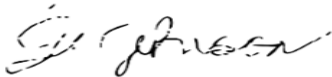
In Reference 1, Tennessee Valley Authority (TVA) submitted to the Nuclear Regulatory Commission (NRC) in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and Standards," paragraph (z)(1), a request to use an alternative for the Browns Ferry Nuclear Plant, Units 1, 2, and 3, to utilize the requirements of the Boiling Water Reactor Vessel and Internals Project Inspection and Evaluation Guidelines in lieu of the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, examination requirements for Examination Categories B-N-1 and B-N-2.

In Reference 2, the NRC transmitted a request for additional information (RAI) and requested a response by August 12, 2020. The enclosure to this letter provides the TVA response to the RAI.

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There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Gordon Williams, Senior Manager, Fleet Licensing (Acting) at 423-751-2687.

Respectfully,

A handwritten signature in black ink, appearing to read "Jonathan T. Johnson".

Jonathan T. Johnson
Director, Nuclear Regulatory Affairs (Acting)

Enclosure:

Response to Request for Additional Information

cc: (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

Request for Additional Information

By letter dated February 28, 2020, (Agencywide Documents Access and Management System (ADAMS), Accession No. ML20059N637), Tennessee Valley Authority (TVA, the licensee), submitted Proposed Alternative Request No. 0-ISI-47 (Proposed Alternative) to certain requirements of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), for the third, fifth and fourth 10-year inservice inspection (ISI) intervals for the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, respectively. Specifically, pursuant to Title 10 of the Code of Federal Regulations (10 CFR) paragraph 50.55a(z)(1), the licensee requested approval to implement alternative Boiling Water Reactor Vessel and Internals Program (BWRVIP) Guidelines in lieu of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1 and B-N-2 requirements.

The U.S. Nuclear Regulatory Commission's (NRC's) Vessels and Internals Branch (NVIB) staff is reviewing the application and has identified areas where it needs additional information to support its review. In order for the NRC staff to determine if the proposed alternative may be authorized pursuant to 10 CFR 50.55a(z)(1), the staff requests the licensee provide the following additional information.

RAI 1

The regulations at 10 CFR 50.55a(g)(4) require inservice inspection of ASME Code Class 1 components to be performed in accordance with Section XI of the ASME Code. The licensee has proposed an alternative to the inspection requirements of Section XI for ASME Code Class 1, Examination Category B-N-1 and B-N-2 components. The licensee proposed that the lower plenum inspection be performed in accordance with BWRVIP Topical Report, BWRVIP-47-A, "BWR Vessel and Internals Project Boiling Water Reactor Lower Plenum Inspection and Flaw Evaluation Guidelines."

Section 3.2.4 in BWRVIP-47-A states that no additional inspections are recommended beyond the baseline inspections, and scope expansion and follow-on inspections deemed necessary in the event flaws are found. Section 3.2.4 in BWRVIP-47-A also states, in part, that baseline inspection results will be reviewed by the BWRVIP and, if deemed necessary, reinspection recommendations will be developed at a later date and provided to the NRC. The NRC staff concluded in the final safety evaluation (BWRVIP-47-A, Appendix C, Section 2.3) that the "BWRVIP committed to address the issue of reinspection in the future after initial baseline inspections have been completed by a majority of U. S. BWRs. The staff accepted this commitment."

Because the licensee's proposed alternative references an safety evaluation with an unresolved commitment, and the BWRVIP has not yet provided revised inspection guidance, the NRC staff requests that the licensee address the following related to the inspection of the lower plenum components:

- Discuss whether inspections of the lower plenum components are planned for the third, fifth and fourth ISI intervals at BFN Units 1, 2 and 3, respectively.
- Discuss whether the lower plenum components at BFN, Units 1, 2, and 3 are accessible for inspection.
- If inspections are not planned and lower plenum components are accessible, provide a technical basis describing how the integrity and function of the lower plenum supports will be maintained regarding potential degradation due to intergranular stress corrosion cracking (IGSCC).

RAI 1 Response

1. No inspections of the lower plenum are planned for the third, fifth, and fourth ISI intervals at BFN Units 1, 2, and 3, respectively.
2. BFN Units 1, 2, and 3, lower plenum components are not accessible during normal refueling outages. They are only accessible in limited areas when special maintenance activities are performed such as removal of guide tubes and Jet Pump assemblies.
3. The baseline lower plenum exams per BWRVIP-47-A (Control Rod Guide Tube welds and Guide Tube & Fuel Support Alignment Pin-to-Core Plate Weld, and the Alignment Pin) were completed for 10 percent of the total Control Rod Guide Tube population (19 blades) for all three units with no reportable indications.

BWRVIP-47-A, Section 3.2.5, provides the following guidance regarding lower plenum inspections.

The BWRVIP has determined that removing or dismantling of internal components for the purpose of performing inspections is not warranted to assure safe operation. However, on occasion, utilities may have access to the lower plenum due to maintenance activities not part of normal refueling outage activities. In such cases, utilities will perform a visual inspection to the extent practical. Results of the inspection will be reported to the BWRVIP and will be forwarded by the BWRVIP to the NRC.

BFN performs and will continue to perform a VT-3 of the accessible components when maintenance activities are performed allowing access to the lower plenum (e.g., a guide tube(s) is pulled, or jet pump disassembled).

RAI 2

BWRVIP-62-A, "Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection," regarding the noble metal chemical addition (NMCA) process and hydrogen water chemistry (HWC), moderate (HWC-M), has been accepted for use as the bases for claiming relief from certain BWRVIP inspections. As described in BWRVIP-62-A, NMCA is a process in which noble metal is added in batches to the reactor coolant system during refueling outages, and small amounts of hydrogen are continuously injected during plant operation. The NRC staff safety evaluation for BWRVIP-62 accepted for use three criteria that plants applying noble metal chemistry must meet to demonstrate mitigation of IGSCC:

- 1) *Measured electrochemical potential (ECP) less than or equal to -230 millivolts (mV).*
- 2) *Measured hydrogen-to-oxygen molar ratio greater than or equal to 3.*
- 3) *Measured catalyst loading greater than or equal to a specific proprietary value.*

BWRVIP-62-A is referenced by other BWRVIP inspection and evaluation guidelines, and implementation of water chemistry in accordance with BWRVIP-62-A is credited to reduce the inspections identified in those documents.

By letter dated January 24, 2018, "Electric Power Research Institute - Status of BWRVIP-62 Revision and Inspection Relief for BWR Piping Welds and Internal Components with Hydrogen

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Injection” (ADAMS Accession No. ML18033A323), the BWRVIP stated that the BWRVIP had issued the following interim guidance to its members:

U.S. plants utilizing all forms of HWC and crediting HWC shall meet the conditions and limitations of BWRVIP-62-A. In the case of plants utilizing OLNC [online noble metal chemistry], this means they shall meet the Category 3a NMCA parameters and implementation steps (including platinum loading) of Tables 3-5 and 3-8. This guidance is issued as NEI 03-08 ‘Needed’ guidance.

Because OLNC is one method to introduce noble metal, plant-specific implementation of OLNC, which demonstrates conformance with the performance criteria of BWRVIP-62-A, can utilize the inspection credit as specified in sources referencing BWRVIP-62-A, consistent with the BWRVIP interim guidance provided in its January 24, 2018, letter to the NRC.

The licensee submittal dated February 28, 2020 did not identify the method of chemical mitigation for IGSCC as described above. Since there is a correlation between the chemical mitigation program implemented and the inspection frequency specified by the BWRVIP alternative, staff requires additional information to complete its review.

- 1. Identify the type of chemical mitigation method that is being implemented at BFN, Units 1, 2, and 3.*
- 2. Identify how the conditions and limitations of BWRVIP-62-A are being met. In addition, if the chemical mitigation method is OLNC, provide information specific to the Category 3A NMCA parameters and implementation steps as described in the safety evaluation to the 2018 supplement to the BWRVIP-62-A report (ADAMS Accession No. ML18142A019).*

RAI 2 Response

1. NMCA was first performed on the three units at BFN as follows.

Unit 1 - November 2007

Unit 2 - March 2001 (NOTE: A second NMCA was performed in April 2009)

Unit 3 - April 2000

On-Line NobleChem™ (OLNC) is the type of chemical mitigation now being implemented at BFN. It was first performed on the three units at BFN as follows.

Unit 1 - February 2014

Unit 2 - October 2015

Unit 3 - November 2010

On-Line NobleChem™ (OLNC) continues to be performed annually on all three units at BFN.

2. BWRVIP-62-A provides the technical basis for the inspection relief in the BWR Vessel Internals (BWRVI) and ISI Programs that is permitted when HWC, NMCA, or OLNC are effectively implemented. It is noted that BFN currently does not claim inspection relief. If inspection relief credit is taken in the future, BFN will do so in accordance with BWRVIP-62-A and NEI 03-08, “Guideline for the Management of Materials Issues.”

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One of the parameters for an effective mitigation program is that the noble metal loading (platinum (Pt) and rhodium) should be maintained above $0.1 \mu\text{g}/\text{cm}^2$ to ensure that the local ECP is reduced below -230 mV (standard hydrogen electrode (SHE)) when a molar ratio of hydrogen to oxidants as oxygen of ≥ 2 is established. It is at this point when IGSCC is considered mitigated.

HWC Availability is defined as the percentage of the time with reactor coolant temperature $\geq 200^\circ\text{F}$ that conductivity is maintained at or below Action Level 1 ($0.3 \mu\text{S}/\text{cm}$) of the BWR Water Chemistry Guidelines and that the ECP of the surface of the weld or component of interest is maintained $\leq -230 \text{ mV}$ (SHE).

- If multiple ECP measurements are available in the same region, the time interval during which ECP is maintained $\leq -230 \text{ mV}$ (SHE) is based on the most conservative (i.e., highest) valid ECP measurement.
- Measured ECP values are conservatively adjusted for tolerances as provided by the vendor specifications for the reference electrodes.

For effective mitigation, the catalyst loading on system surfaces must be sufficient to reduce the ECP to $\leq -230 \text{ mV}$ (SHE) when a molar ratio of hydrogen to oxidants as oxygen of ≥ 2 is established. The minimum catalyst for mitigation is $0.1 \mu\text{g}/\text{cm}^2$.

BFN uses durability monitor coupons as a means of determining catalyst loading for Units 1, 2, and 3. The latest coupon loading results are summarized below.

Unit	Coupon Serial #	Date Removed	Pt Loading ($\mu\text{g}/\text{cm}^2$)
1	2010-093	05/01/2018	0.08
2	2009-281	08/30/2018	0.09
3	2009-107	08/30/2018	0.19

As can be seen above, catalyst loading is sufficient for Unit 3 to demonstrate mitigation, but both Units 1 and 2 are below $0.1 \mu\text{g}/\text{cm}^2$.

In accordance with the BWRVIP Water Chemistry Guidelines (BWRVIP-190 Revision 1: BWR Vessel and Internals Project 2014), a hydrogen benchmark/ramp test is required to be conducted to validate secondary parameters once every ten years and after implementing a major operating change. This ramp test verifies the amount of hydrogen required to mitigate IGSCC in the regions of interest within the reactor. This test was performed in February 2020 for Unit 2 and an adequate amount of hydrogen was found to be available to mitigate IGSCC. (NOTE: The test was also performed in June 2020 for Unit 1, and TVA is awaiting test results. The Unit 3 test is currently scheduled for August 2020.) Therefore, despite the coupon deposition being less than the required $0.1 \mu\text{g}/\text{cm}^2$ for Unit 2, the catalyst loading available was sufficient to reduce the ECP to $\leq -230 \text{ mV}$ (SHE).

RAI 3

The licensee's proposed alternative states:

When a BWRVIP Guideline refers to ASME Section XI, the technical requirements of ASME Section XI as described by the BWRVIP Guideline will be met, but the examination is under the jurisdiction of the BWRVIP Program as

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defined by BWRVIP-94, "BWRVIP Vessel and Internals Project Program Implementation Guide." When implementing the guidance of BWRVIP-94, BFN Units 1, 2, and 3 will meet the following:

"When BWRVIP Guidelines are approved by the Executive Committee and are initially distributed, or subsequently revised, each utility shall modify their vessel and internals program documentation to reflect the new requirements and shall implement the guidance within two refueling outages, unless a different schedule is identified by the BWRVIP at the time of document distribution. Implementation is to be based on the date of the distribution/notification letter to the members. Implementation means not only incorporating the requirements into the utility program, but also performing the initial or baseline inspection and evaluation requirements.

However, if new guidance approved by the Executive Committee includes revisions to NRC approved guidance that are less conservative than those approved by the NRC, this less conservative guidance shall be implemented only after NRC approves the change or if the guidance is approved through the NEI 03-08 screening process."

Therefore, where the revised version of a BWRVIP Inspection Guideline continues to also meet the requirements of the version of the BWRVIP Inspection Guideline that forms the safety basis for the NRC authorized proposed alternative to the requirements of 10 CFR 50.55a, it may be implemented. Otherwise, the revised Guidelines will only be implemented after NRC approval of the revised BWRVIP Guidelines, approved through the NEI 03-08 document screening process, or approved by the NRC as a plant-specific request for an alternative.

The NRC staff is unable to approve the licensee proposal that BWRVIP guidelines can be revised without a subsequent plant-specific request, because the licensee is requesting to use revisions of BWRVIP Topical Reports that are not available for review by NRC staff. Therefore, the NRC staff requests that the licensee remove the above paragraphs from the proposed alternative request.

RAI 3 Response

For the purposes of BWRVIP documents that apply to taking BWRVIP credit for ASME Section XI exams, TVA will use the document revisions in effect at the time of approval of the alternative unless specific approval is obtained from the NRC. Consider the information quoted above in RAI 3 removed from the requested alternative.