



1101 Market Street, Chattanooga, Tennessee 37402

CNL-23-071

January 11, 2024

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: **Response to Request for Additional Information Regarding Browns Ferry Nuclear Plant, Units 1, 2, and 3, Inservice Inspection and Augmented Program Interval Revised Request for Alternative 0-ISI-47 (EPID L-2023-LLR-0034)**

- References:
1. TVA Letter to NRC, CNL-23-025, "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 Revised Request for Alternative 0-ISI-47," dated July 3, 2023 (ML23184A142)
  2. NRC electronic mail to TVA, "Request for Additional Information Related to Proposed Revised Alternative 0-ISI-47 (EPID L-2023-LLR-0034)" dated November 27, 2023 (ML23332A004)

In Reference 1, Tennessee Valley Authority (TVA) submitted a revised request for 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 Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) and requested that TVA respond by January 11, 2024. The enclosure to this letter provides the response to the RAI.

U.S. Nuclear Regulatory Commission

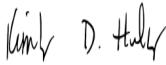
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There are no new regulatory commitments in this letter. Please address any questions regarding this submittal to Stuart L. Rymer, Senior Manager, Fleet Licensing, at [slrymer@tva.gov](mailto:slrymer@tva.gov).

Respectfully,



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Kimberly D. Hulvey  
Director, Nuclear Regulatory Affairs

Enclosure:

Response to NRC Request for Additional Information

cc:

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

Enclosure

Response to NRC Request for Additional Information

**Introduction:**

*By letter dated July 3, 2023, (Agencywide Documents Access and Management System (ADAMS), Accession No. ML23184A142), Tennessee Valley Authority (TVA), submitted Proposed Revised Request for Alternative 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 Plant (Browns Ferry), Units 1, 2, and 3, respectively. Specifically, pursuant to Title 10 of the Code of Federal Regulations (10 CFR), paragraph 50.55a(z)(1), TVA 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 (NRC) staff is reviewing the request 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 following additional information.*

**Background:**

*Nuclear Energy Institute (NEI) 03-08, "Guideline for the Management of Materials Issues," Revision 4 (ML20315A536) provides the industry's process for determining when an updated industry inspection and evaluation guideline may be implemented by an industry licensee without NRC prior approval of the guideline. TVA proposes to use BWRVIP-48, Revision 2, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," as the basis for inspecting reactor pressure vessel interior attachment welds in lieu of applicable ASME Section XI, Examination Category B-N-2 requirements or the most recent NRC-approved revision BWRVIP-48-A. BWRVIP-48, Revision 2 was not submitted to the NRC staff for review and approval.*

**Requests for Additional Information:**

**RAI 1**

**Issue**

*Table 1 and Sections 2 and 3 of the Enclosure to the July 3, 2023, letter describe the changes between BWRVIP-48-A and BWRVIP-48, Revision 2, regarding the ASME Code inspection requirements for the B13.20 and B13.30 components. TVA stated that several components inspected in accordance with BWRVIP-48, Revision 2 are inspected by EVT-1 methodology in lieu of VT-1 or VT-3 and why the proposed inspection methodology is more conservative.*

**Request**

*Discuss the plant-specific bases for Browns Ferry Units 1, 2, and 3 that demonstrate that the proposed reduction in frequency of inspection provides an acceptable alternative to ASME Code requirements or BWRVIP-48-A for the inspection of the applicable reactor pressure vessel interior attachments welds.*

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TVA Response to RAI 1

The plant-specific bases for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 that demonstrate that the proposed reduction in frequency of inspection provides an acceptable alternative to ASME Code requirements or BWRVIP-48-A for the inspection of the applicable reactor pressure vessel interior attachments welds is provided below.

The revised request for alternative (RFA) (Reference 1) identified three instances of extended frequencies compared to the frequencies in the prior NRC Safety Evaluation (Reference 2). The jet pump riser brace, core spray piping bracket, and steam dryer support bracket attachment welds to the vessel, and associated heat affected zones (HAZs), are identified as the applicable reactor pressure vessel interior attachment welds with extended inspection frequencies applied in BWRVIP-48, Revision 2 (Reference 3). The inspection changes between BWRVIP-48-A (Reference 4) and BWRVIP-48, Revision 2, are tabulated in Table 1. In each case where intervals are extended, an enhanced visual examination (EVT-1) requirement is stipulated for the respective component instead of the examination specified in the ASME Code 2007 Edition with 2008 Addenda. The advantage of the enhanced examination technique is detailed in BWRVIP-48, Revision 2, Appendix G, Section G.4.4.1 (Reference 5). BWRVIP-48, Revision 2, Appendix G, Section G.4.4.1 also describes further advancements of the EVT-1 examination technique itself since the issuance of BWRVIP-48-A.

Table 1:

Component	ASME Code Sec. XI IWB Inspection Requirement	BWRVIP-48-A Interval	BWRVIP-48 R2 Interval (Reference 5)	BWRVIP-41 R4-A Interval	BWRVIP-18 R2-A Interval Note 1
Core Spray Piping Bracket Attachment	B-N-2, VT-3 of 100% each 10-year interval	EVT-1 of 100% every 8 years	Table G-10, Row "Core Spray Piping, Ni-Base Alloy," Column 5	Not Applicable (N/A)	EVT-1 of 100% of weld HAZs every 10 years
Steam Dryer Support Bracket Attachment	B-N-2, VT-3 of 100% each 10-year interval	EVT-1 of 100% every 10 years	Table G-10, Row "Steam Dryer Support, Ni-Base Alloy," Column 5	N/A	N/A
Jet Pump Riser Brace Attachment	B-N-2, VT-1 of 100% each 10-year interval	EVT-1 of 25% every 6 years	Table G-10, Row "Jet Pump Riser Brace (HWC)," Column 5 Note 2	EVT-1 of 25% every 12 years Note 3	N/A

**Note 1:** BWRVIP-18 R2-A offers inspection and evaluation guidance for the core spray piping within the reactor vessel and addresses core spray piping brackets at an interval that matched BWRVIP-48 R1 prior to release of BWRVIP-48 R2.

**Note 2:** Intervals are based off of Hydrogen Water Chemistry (HWC) mitigation inspection allowance.

**Note 3:** BWRVIP-41 R4-A offers inspection and evaluation guidance for the jet pumps and further addresses the jet pump riser brace attachment welds.

The examination guidance for core spray piping bracket attachment welds is provided in BWRVIP-48, Revision 2, Table G-10. This represents a change from the EVT-1 of 100 percent (%) core spray piping bracket attachment welds every eight years as listed in BWRVIP-48-A. The technical justification for changing the inspection frequency is detailed in

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### Response to NRC Request for Additional Information

BWRVIP-48, Revision 2, Appendix G, Section G.4, "Qualitative Risk Assessment for BWRVIP-48, Rev. 2," and Section G.5, "Summary of Inspection Program Revisions." The technical justification supersedes the evaluations from prior versions of BWRVIP-48. However, because BFN also implements the NRC-approved guidance in Table 3-1 of BWRVIP-18, Revision 2-A (Reference 6), which addresses the vessel internal core spray piping system including the bracket attachment welds and HAZs, BFN uses the more restrictive inspection requirement of EVT-1 examination of 100% of these welds every 10 years to satisfy both BWRVIP-18, Revision 2-A and BWRVIP-48, Revision 2 simultaneously. This interval is less than that justified in the Qualitative Risk Assessment and is on the same 10-year interval as required in ASME Code, Section XI, thereby providing a reasonable assurance of safety.

The technical justification for extending the inspection frequency for the jet pump riser brace and steam dryer support bracket attachment welds is contained in BWRVIP-48, Revision 2, Appendix G, Section G.4, "Qualitative Risk Assessment for BWRVIP-48, Rev. 2," and Section G.5, "Summary of Inspection Program Revisions." Further noted is precedence of expanded intervals approved by the NRC using similar justification in BWRVIP-41, Revision 4-A (Reference 7) and BWRVIP-48-A which, in both instances, received a safety evaluation for the examination of the jet pump riser brace attachment welds at intervals greater than 10 years via a sampling inspection process. These documents were determined to provide a reasonable assurance of safety.

Reference 5 includes Appendix G of BWRVIP-48, Revision 2 as documentation of the technical justification performed for the established examination requirements and Nuclear Energy Institute (NEI) 03-08, "Guideline for the Management of Materials Issues," Revision 4 (Reference 8), Appendix C screening of the document. Reference 5 also includes Appendix H of BWRVIP-48, Revision 2 listing the revision details in Table H-1.

Examination data at all three BFN units for the components listed were reviewed by TVA to assess whether site specific data was reflective of the data identified as a technical contributor in the conclusions drawn from the Qualitative Risk Assessment in BWRVIP-48, Revision 2, Appendix G. This review of examination data confirmed 72 EVT-1 examinations of the core spray piping bracket attachment welds, 31 EVT-1 examinations of the steam dryer support bracket attachments, and 228 EVT-1 examinations of the jet pump riser brace attachments have been performed since 1997 and establishment of the BWRVIP program. For the jet pump riser brace, steam dryer support, and core spray piping bracket attachments this represents a full baseline examination of the entire population with at least one full reinspection of the entire population for these components on all three BFN units. The weld inspections are rotated in such a way that the entire population of the welds are examined, with the welds that were examined the farthest in the past being selected for the next examination campaign and so forth. Of those examinations, one indication of a cracked core spray piping bracket tack weld and four steam dryer support bracket wear locations have been reported. None of these indications are associated with any reported degradation of the attachment welds to the vessel. The indications identified are typical of tack weld flaws and the wear found is commensurate of wear described as common industry occurrence to the steam dryer support brackets in the Qualitative Risk Assessment. Furthermore, no indications representative of vessel attachment weld degradation have been reported for any attachment in Reference 1 for any BFN unit. This review of BFN examinations confirms that the data collected by Electric Power Research Institute (EPRI) is comparable to the specific results at BFN and supports the applicability of the technical justification presented in the Qualitative Risk Assessment of BWRVIP-48, Revision 2, Appendix G.

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### Response to NRC Request for Additional Information

Review of the Qualitative Risk Assessment performed in BWRVIP-48, Revision 2 and the site specific data acquired at BFN demonstrated that the analysis is applicable to BFN Units 1, 2, and 3 with appropriate justification for extending examination intervals for the components described without presenting a challenge adverse to safety or quality.

#### **RAI 2**

##### Issue

*However, the submittal does not provide justification for the reduction in inspection frequency for B13.20 riser braces and B13.30 steam dryer support brackets nor does it describe methodology for selection of the riser braces.*

##### Request

*Describe the sampling methodology for all components proposed to be inspected at a frequency less than that specified in the ASME Code or BWRVIP-48-A that are covered by the alternative request.*

##### TVA Response to RAI 2

The components that are proposed to be inspected at a frequency less than that specified in the ASME Code or BWRVIP-48-A are listed in Table 1 of the response to RAI 1. The sampling methodology for these components is described below.

BFN utilizes the sampling process described in both BWRVIP-48, Revision 2 and BWRVIP-41, Revision 4-A when selecting the welds to be examined each refueling outage. This sampling process ensures the entire weld population is cycled through the inspection program over the specified period of time.

In Table 1 of Reference 1, periodic inspection requirements for some components are specified as a percentage sample of the weld population to be inspected in a specified time interval (i.e., "25% every x years"). In implementing this requirement, BFN Units 1, 2, and 3 selects jet pump riser brace attachment welds for inspection based on accumulated service time since the weld was last inspected. Using this approach, weld selection for inspection is rotated through the entire jet pump riser brace attachment weld population based on accumulated service time (i.e., a different 25% sample is to be selected each inspection interval such that the total weld population is inspected per the applicable period). In the above example, "25% every x years", the entire weld population for that component (100%) would be examined over 4x years. Specifically for jet pump riser braces which call for 25% every 12 years, the entire weld population would be examined over a 48-year period.

Table 1 of Reference 1 addresses the core spray piping bracket attachments as requiring inspection of 100% in a 10-year time period based on BWRVIP-18, Revision 2-A. This is equivalent to the 10-year inspection interval required for B-N-2 attachment welds in Section XI of the ASME Code, but the interval is less frequent than the eight year inspection period in BWRVIP-48-A. BWRVIP-48, Revision 2 stipulates further reduction in frequency to an examination interval listed in Table G-10. TVA is not requesting the use of the extended interval in BWRVIP-48, Revision 2 for BFN Units 1, 2, and 3. Rather, TVA performs the exams per the

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BWRVIP-18, Revision 2-A guidance which is 100% of the welds in a 10-year period utilizing the EVT-1 examination technique. This technique is more stringent than the ASME required VT-3 examination and is performed on the same frequency as the code interval. These welds are sampled as described above for jet pump riser brace attachment welds with the only difference being that 100% of the population is examined in a 10-year interval and no core spray piping bracket attachment weld will go longer than five refueling outages (10 years) before being reinspected. The core spray piping bracket attachment welds may be performed at one time or spread out over the 10-year period as long as the next inspection of each individual weld does not exceed 10 years since its last inspection. Within this examination, a VT-3 of the hardware and general condition of the bracket is also performed in conjunction with the EVT-1 inspection of the core spray piping bracket attachment weld to meet BWRVIP-18, Revision 2-A guidance.

Table 1 of Reference 1 requires the entire population (100%) of the steam dryer support bracket attachment welds to be examined over a 12-year period. In this instance, the entire population may be examined at one time then re-examined 12 years later, or these four exams may be spread out over the 12-year period. If the four examinations are spread out over multiple outages, the sample each outage shall be determined such that no single steam dryer support bracket attachment weld will go longer than 12 years since its previous inspection.

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### Response to NRC Request for Additional Information

#### **References:**

1. TVA Letter to NRC, CNL-23-025, "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 Revised Request for Alternative 0-ISI-47," dated July 3, 2023 (ML23184A142)
2. NRC Letter to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Proposed Alternative to the Requirements of the ASME Code (EPID L-2019-LLR-0034)1," dated September 23, 2020 (ML20253A181)
3. "BWRVIP-48, Revision 2: BWR Vessel and Internals Project: Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," EPRI, Palo Alto, CA: 2021. 3002018321.
4. "BWRVIP-48-A: BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," EPRI, Palo Alto, CA: 2004. 1009948.
5. Entergy Letter to NRC, CNRO2023-00015, "Response to Request for Additional Information concerning Request to Update ASME Code Relief Request Safety Evaluations with NRC-Approved Revision of BWRVIP Guidelines (GG-ISI-020, and RBS-ISI-019)," dated June 8, 2023 (ML23159A229)
6. "BWRVIP-18, Revision 2-A: BWR Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines," EPRI, Palo Alto, CA: 2016. 3002008089.
7. "BWRVIP-41, Revision 4-A: BWR Vessel and Internals Project: BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines," EPRI, Palo Alto, CA: 2018. 3002014254.
8. NEI 03-08, Revision 4, "Guideline for the Management of Materials Issues," dated October 2020 (ML20315A536)