



1101 Market Street, Chattanooga, Tennessee 37402

CNL-23-025

July 3, 2023

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 – 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**

- 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 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)

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

Specifically, TVA requests the use of the BWRVIP I&E guidelines for the Examination Item Numbers B13.10 (vessel interior), B13.20 (interior attachments within beltline region), B13.30

¹ The safety evaluation for BFN contains an incorrect EPID number in the title. The correct number should be EPID L-2020-LLR-0034.

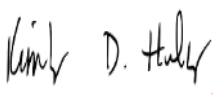
(interior attachments beyond beltline region), and B13.40 (core support structure) in the above examination categories. The BWRVIP I&E guidelines focus on specific and susceptible components, specify appropriate inspection methods capable of identifying real anticipated degradation mechanisms, and require re-examination at conservative intervals. The scope of the BWRVIP guidelines meet or exceed that of ASME BPVC Section XI and, in many instances, include components that are not part of the ASME BPVC Section XI jurisdiction.

In Reference 1, TVA submitted request for alternative 0-ISI-47 regarding the use of BWRVIP guidelines in lieu of ASME Code requirements. Request for alternative 0-ISI-47 was approved by the NRC in Reference 2. The approved request for alternative currently refers to the use of BWRVIP-03 Revision 19, BWRVIP-25, BWRVIP-41 Revision 3, BWRVIP-48-A, and BWRVIP-94 Revision 2. Newer revisions of these documents, specifically BWRVIP-03 Revision 20, BWRVIP-25 Revision 1-A, BWRVIP-41 Revision 4-A, BWRVIP-48 Revision 2, and BWRVIP-94 Revision 4, have been issued. Additionally, BWRVIP-62 Revision 2 has been issued since NRC approval of 0-ISI-47 and was not included in that request. In the case of BWRVIP-25 and BWRVIP-41, the newer revisions have been approved by the NRC. In the case of BWRVIP-03, BWRVIP-48, BWRVIP-62, and BWRVIP-94, the latest revisions have not been reviewed and approved by the NRC, but have been evaluated in accordance with NEI 03-08, "Guideline for the Management of Materials Issues," Appendix C, "Document Screening." Request for alternative 0-ISI-47 is proposed to be revised to allow for use of BWRVIP-03 Revision 20, BWRVIP-25 Revision 1-A, BWRVIP-41 Revision 4-A, BWRVIP-48 Revision 2, BWRVIP-62 Revision 2, and BWRVIP-94 Revision 4 rather than the older revisions as previously approved. No other changes to the previously approved request for alternative are being proposed. The revised request for alternative 0-ISI-47 is enclosed.

TVA requests NRC approval of this request within one year following the date of this submittal.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Stuart L. Rymer, Senior Manager, Fleet Licensing, at srymer@tva.gov.

Respectfully,



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Kimberly D. Hulvey
Director, Nuclear Regulatory Affairs

Enclosure:

Tennessee Valley Authority, Browns Ferry Nuclear Plant, Units 1, 2, and 3, American Society of Mechanical Engineers Section XI, Inservice Inspection and Augmented Program Interval Revised Request for Relief 0-ISI-47

cc: (See Page 2)

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cc (Enclosure):

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

Tennessee Valley Authority
Browns Ferry Nuclear Plant, Units 1, 2, and 3
American Society of Mechanical Engineers Section XI
Inservice Inspection and Augmented Program Interval
Revised Request for Relief 0-ISI-47

ASME Code Component(s) Affected

Code Class: 1
Reference: IWB- 2500-1
Examination Category: B-N-1 and B-N-2
Item Number(s): B13.10, B13.20, B13.30, and B13.40
Description: Use of Boiling Water Reactor Vessel and Internals Project (BWRVIP) Guidelines in Lieu of Specific American Society of Mechanical Engineers (ASME) Section XI Code Requirements on Reactor Pressure Vessel (RPV) Internals and Components Inspection
Component Name(s): Vessel interior, interior attachments within beltline region, interior attachments beyond beltline region, and core support structure

Applicable Code Edition and Addenda

ASME Section XI, 2007 Edition with 2008 Addenda

Applicable ASME Code Requirements

ASME Code Section XI requires the examination of components within the RPV. These examinations are included in Table IWB-2500-1, Examination Categories B-N-1 and B-N-2 and identified with the following Item Numbers.

- B13.10 Examine accessible areas of the reactor vessel interior each inspection period by the VT-3 method as defined in IWA-2213 of ASME Code Section XI (Category B-N-1).
- B13.20 Examine interior attachment welds within the beltline region each inspection interval by the VT-1 method as defined in IWA-2211 of ASME Code Section XI (Category B-N-2).
- B13.30 Examine interior attachment welds beyond the beltline region each inspection interval by the VT-3 method as defined in IWA-2213 of ASME Code Section XI (Category B-N-2).
- B13.40 Examine surfaces of the welded core support structure each inspection interval by the VT-3 method as defined in IWA-2213 of ASME Code Section XI (Category B-N-2).

These examinations are performed to assess the structural integrity of the reactor vessel interior, its welded attachments, and the welded core support structure within the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 boiling water reactor (BWR) pressure vessels.

The components or welds listed in Table 1 are subject to this request for alternative. Table 1 provides only an overview of the ASME and BWRVIP requirements. For more details, refer to ASME Section XI, Table IWB-2500-1, Examination Categories B-N-1 and B-N-2 and the appropriate BWRVIP documents.

Reason for Request

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), Tennessee Valley Authority (TVA) is requesting Nuclear Regulatory Commission (NRC) approval of a proposed revised alternative to the ASME Code Section XI requirements provided above for BFN Units 1, 2, and 3 on the basis that the use of the BWRVIP guidelines discussed below will provide an acceptable level of quality and safety.

TVA submitted a request for alternative dated February 28, 2020 (Reference 1), and supplemented that request with letters dated August 10, 2020 (Reference 2) and September 10, 2020 (Reference 3). NRC approval was received September 23, 2020 (Reference 4) with concluding statements that the safety evaluation (SE) approves only the use of those versions of the BWRVIP topical reports that were requested in the original licensee submittal and supplemental letters. The SE acknowledges that use of later versions of BWRVIP topical reports at BFN Units 1, 2, and 3 for the third, fifth, and fourth 10-year inservice inspection (ISI) intervals, respectively, requires the licensee to submit a new request for approval.

The BWRVIP inspection and evaluation (I&E) guidelines recommend specific inspections by BWR operators to identify material degradation with BWR components. A wealth of inspection data has been gathered during these inspections across the BWR industry. The BWRVIP I&E guidelines focus on specific and susceptible components, specify appropriate inspection methods capable of identifying known or potential degradation mechanisms, and require re-examination at appropriate intervals. The scope of the BWRVIP I&E guidelines meet or exceed that of ASME Section XI and, in many instances, include additional components that are not part of the ASME Section XI jurisdiction.

Proposed Alternative and Basis for Use

In lieu of the requirements of ASME Section XI, the proposed alternative is detailed in Table 1 for BFN Units 1, 2, and 3 for Examination Categories B-N-1 and B-N-2.

TVA will satisfy the Examination Category B-N-1 and B-N-2 requirements at BFN Units 1, 2, and 3 as described in Table 1 in accordance with BWRVIP guidelines in lieu of the associated ASME Code Section XI requirements, including examination method, examination volume, frequency, training, successive and additional examinations, flaw evaluations, and reporting. Table 1 compares current ASME Code Section XI, Table IWB-2500-1, Examination Category B-N-1 and B-N-2 requirements with the current BWRVIP guideline requirements listed in Table 2, for BWR/4s as applicable, to BFN Units 1, 2, and 3. The proposed alternative is discussed in Attachment 1, "Comparison of Code Examination Requirements to BWRVIP Examination Requirements," which shows a comparison between the existing ASME Code Section XI and BWRVIP requirements that will be used under this alternative.

Not all the components addressed by these guidelines are ASME Section XI components. The BWRVIP guidelines listed below in Table 2 will be used to inspect the ASME Section XI components for which relief is requested.

Enclosure

BWRs now examine reactor internals in accordance with BWRVIP guidelines. These guidelines have been written to address the safety significant vessel internal components and to examine and evaluate the examination results for these components using appropriate methods and reexamination frequencies. The BWRVIP has established a reporting protocol for examination results and deviations. The NRC has agreed with the BWRVIP approach in principal and has issued (SEs) for many of these guidelines (References 6 - 9 and 13 - 21), including NRC approval for BFN received September 23, 2020 (Reference 4).

As additional justification, Attachment 1 provides specific examples that compare the inspection requirements of ASME Code Section XI Item Numbers B13.10, B13.20, B13.30, and B13.40 in Table IWB-2500-1, to the inspection requirements in the BWRVIP documents. This comparison also includes a discussion of the inspection methods and where they are applied.

All attachment welds were fabricated from either E-308/E-309 (furnace sensitized) austenitic stainless steel or Inconel 82/182 material, which have an increased concern for cracking (BWRVIP-48, Revision 2, Section 3.2.1) (Reference 5). With exception of core spray piping bracket attachment welds, future examinations of the RPV attachment welds will meet the inspection strategy in Section 3 of BWRVIP-48, Revision 2 and BWRVIP-38 (Reference 6). BWRVIP-18, Revision 2-A (Reference 7) provides specific guidance to inspection of the core spray system and applies a more conservative examination interval to the bracket attachment welds, therefore this interval will be incorporated in lieu of the less conservative interval provided in BWRVIP-48, Revision 2. Furthermore, the inspection strategy for the core spray piping bracket attachment welds will incorporate the examination volume stipulated in both BWRVIP-48, Revision 2, and BWRVIP-18, Revision 2-A.

Any deviations from the referenced BWRVIP guidelines for the duration of the proposed alternative will be appropriately documented and communicated to the NRC, per the BWRVIP deviation disposition process. Currently, TVA has two active deviations. A deviation exists for a jet pump repair clamp on the riser pipe between Jet Pumps 5 and 6 on Unit 3, and a second deviation exists for a variance from BWRVIP I&E guidelines for examination of jet pump hold-down beam (BB-1 Region) for Unit 3 Jet Pumps 2 and 13.

In the event that conditions are identified that require repair or replacement activities and the component is within the jurisdiction of ASME Code Section XI (welded attachments to the RPV or core support structure), the repair and replacement activities will be performed in accordance with ASME Code Section XI, Article IWA-4000. Subsequent examinations will be in accordance with the applicable BWRVIP guideline.

As part of the BWRVIP initiative, the BWR reactor internals and attachments were subjected to a safety assessment to identify those components that provide a safety function and to determine if long-term actions were necessary to ensure continued safe operation. The safety functions considered are those associated with (1) maintaining a coolable core geometry, (2) maintaining control rod insertion times, (3) maintaining reactivity control, (4) assuring core cooling, and (5) assuring instrumentation availability. The results of the safety assessment are documented in BWRVIP-06, Revision 1-A, "BWR Vessel and Internals Project, Safety Assessment of BWR Reactor Internals" (Reference 8), which has been approved by the NRC. As a result of BWRVIP-06, Revision 1-A, component-specific BWRVIP guidelines were developed providing appropriate examination and evaluation requirements to address the specific component safety function and potential degradation mechanism.

Browns Ferry meets the hydrogen water chemistry (HWC) and Online NobleChem (OLNC) injection requirements to employ BWRVIP-41, Revision 4-A, "BWR Vessel and Internals Project,

BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines” (Reference 9), as the governing resource for jet pump examinations and acceptance criteria. This NRC approved revision has been updated to extend examination intervals by incorporating the benefits of stress corrosion cracking (SCC) mitigation through chemical control of primary water and is considered a “needed” document according to BWRVIP-94, Revision 4 (Reference 10). These requirements are outlined in BWRVIP-62, Revision 2, “Volume 2: Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection” (Reference 11).

Therefore, based on the SEs of many of the BWRVIP guidelines and the comparisons discussed in the attachment demonstrating the use of these guidelines above, TVA concludes that this alternative request to the ASME Code Section XI requirements will avoid unnecessary inspections because the inspections will then be focused on the most recent BWR experience available. Thus, this request, when authorized, will provide an acceptable level of quality and safety and will not adversely impact the health and safety of the public.

Duration of Proposed Alternative:

Upon authorization by the NRC, this request for an alternative to use the BWRVIP guidelines in lieu of ASME Code Section XI requirements will be implemented during the following intervals:

Unit	Interval	Start date	End date
1	Third 10-Year ISI Interval	02/01/2016	01/31/2026
2	Fifth 10-Year ISI Interval	02/01/2016	01/31/2026
3	Fourth 10-Year ISI Interval	02/01/2016	01/31/2026

Precedents:

The NRC staff has authorized similar requests for the following licensees

- Fermi, Unit 2, “Fermi 2 – Revised Relief Request RR-A39 for the Fourth 10-Year Inservice Inspection Interval (EPID L-2020-LLR-0161,” dated October 15, 2021 (ML21253A010)
- Browns Ferry, Units 1, 2, and 3, “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)
- Hatch, Units 1 and 2, “Edwin I. Hatch Nuclear Plant, Unit Nos. 1 and 2 – Proposed Alternative HNP-ISI-ALT-05-04 for the Implementation of BWRVIP Guidelines (EPID L-2018-LLR-0099),” dated January 22, 2019 (ML19011A010)

¹ The safety evaluation for BFN contains an incorrect EPID number in the title. The correct number should be EPID L-2020-LLR-0034.

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- Perry, Unit 1, “Perry Nuclear Power Plant, Unit No. 1 – Approval of Alternative to Use BWRVIP Guidelines in Lieu of Certain ASME Code Requirements (CAC No. MG0149; EPID L-2017-LLR-0112) (L-17-183),” dated January 29, 2018 (ML18023A625)
- Nine Mile Point, Units 1 and 2, “Nine Mile Point Nuclear Station, Units 1 and 2 – Issuance of Relief Requests Re: Use of Boiling Water Reactor Vessel and Internals Project Guidelines in Lieu of Specific ASME Code Requirements (EPID L-2018-LLR-0085),” dated December 13, 2018 (ML18318A275)
- River Bend, Unit 1, “River Bend Station, Unit 1 – Relief from the Requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code to Use Boiling Water Reactor Vessel Internals Guidelines as an Alternative (EPID L-2018-LLR-0008),” dated November 16, 2018 (ML18310A013)
- Cooper, “Cooper Nuclear Station – Requests for Relief Associated with the Fifth 10-Year Inservice Inspection Interval Program (CAC Nos. MG0175 through MG0179; EPIDs L-2017-LLR-0062 through L-2017-LLR-0066),” dated July 31, 2018 (ML18183A325)
- Peach Bottom, Units 2 and 3, “Peach Bottom Atomic Power Station, Units 2 and 3 – Safety Evaluation of Relief Request I5R-03 Regarding the Fifth 10-Year Interval of the Inservice Inspection Program (EPID No. L-2018-LLR-0056),” dated July 18, 2018 (ML18179A394)
- FitzPatrick, “James A. FitzPatrick Nuclear Power Plant – Relief Requests I5R-02, I5R-03, and I5R-04 for Alternatives to Certain ASME Code Requirements (CAC Nos. MG0116, MG0117, and MG0118; EPID L-2017-LLR-0083, EPID L-2017-LLR-0084, and EPID L-2017-LLR-0085),” dated May 30, 2018 (Accession No. ML18039A854)

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. TVA Letter to NRC, CNL-20-059, “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),” dated August 10, 2020 (ML20223A366)
3. TVA Letter to NRC, CNL-20-079, “Browns Ferry Nuclear Plant, Units 1, 2, and 3, Supplement to American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Inservice Inspection and Augmented Program Interval Request for Alternative 0-ISI-47 (EPID L-2020-LLR-0034),” dated September 10, 2020 (ML20255A150)
4. 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)²,” dated September 23, 2020 (ML20253A181)

² The safety evaluation for BFN contains an incorrect EPID number in the title. The correct number should be EPID L-2020-LLR-0034.

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5. BWRVIP-48, Revision 2, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," Electric Power Research Institute (EPRI) Technical Report 3002018321, dated September 2021
6. NRC Letter to BWRVIP, "Final Safety Evaluation of the 'BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines (BWRVIP-38),' EPRI Report TR-108823 (TAC No. M99638)," dated July 24, 2000 (ML003735498)
7. NRC Letter to BWRVIP, "U.S. Nuclear Regulatory Commission Approval Letter for Electric Power Research Institute Topical Report, BWRVIP-18, Revision 2-A, 'BWR [Boiling Water Reactor] Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines' (TAC No. MF8415)," dated December 21, 2016 (ML16273A083)
8. NRC Letter to BWRVIP, "U.S. Nuclear Regulatory Commission Approval Letter for Technical Report BWRVIP-06, Revision 1-A, 'BWR [Boiling Water Reactor] Vessels and Internals Project, Safety Assessment of BWR Reactor Internals,' Electric Power Research Institute Technical Report 1019058 (TAC No. ME4044)," dated February 17, 2011 (ML110341414)
9. BWRVIP Letter to NRC, "BWRVIP Docket No. 99902016 – BWRVIP-41, Revision 4-A: BWR Vessel and Internals Project, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines," dated October 22, 2019 (ML19297G503)
10. BWRVIP-94, Revision 4, "Program Implementation Guide," EPRI Technical Report 3002019689, dated November 2020 (ML20345A248)
11. BWRVIP-62, Revision 2, "Volume 2: Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection," EPRI Technical Report 3002017199, dated December 2021
12. BWRVIP-03, Revision 20, "Reactor Pressure Vessel and Internals Examination Guidelines," EPRI Technical Report 3002010675, dated August 2021
13. NRC Letter to BWRVIP, "U.S. Nuclear Regulatory Commission Approval Letter with Comment for Technical Report BWRVIP-14-A, 'BWR Vessel and Internals Project, Evaluation of Crack Growth in Boiling Water Reactor Stainless Steel Reactor Pressure Vessel Internals,' EPRI Technical Report 1016569 (TAC ME1509)," dated July 16, 2010 (ML101820213)
14. BWRVIP Letter to NRC, "BWRVIP Docket No. 99902016 – BWRVIP-25, Revision 1-A: BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines," dated October 7, 2020 (ML20290A785)
15. NRC Letter to BWRVIP, "NRC Approval Letter of BWRVIP-26-A, 'BWR Vessel and Internals Project Boiling Water Reactor Top Guide Inspection and Flaw Evaluation Guidelines'," dated August 29, 2005 (ML052490550)
16. NRC Letter to BWRVIP, "Non-Proprietary Version of NRC Staff Review of BWRVIP-27-A, 'BWR Standby Liquid Control System/Core Plate Δ P Inspection and Flaw Evaluation Guidelines'," dated June 9, 2004 (ML041700446)

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17. NRC Letter to BWRVIP, "NRC Approval Letter of BWRVIP-47-A, 'BWR Vessel and Internals Project Boiling Water Reactor Lower Plenum Inspection and Flaw Evaluation Guidelines'," dated September 1, 2005 (ML052490537)
18. BWRVIP Letter to NRC, "Project 704 – 'BWRVIP-49-A: BWR Vessel and Internals Project, Instrument Penetrations Inspection and Flaw Evaluation Guidelines'," dated May 24, 2002 (ML021510018)
19. BWRVIP Letter to NRC, "Project 704 – 'BWRVIP-74-A: BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal'," dated June 18, 2003 (ML031710343)
20. NRC Letter to BWRVIP, "U.S. Nuclear Regulatory Commission Approval Letter for 'BWRVIP-76, Revision 1-A: BWR Core Shroud Inspection and Flaw Evaluation Guidelines' (CAC No. ME8317)," dated December 28, 2015 (ML15307A468)
21. NRC Letter to BWRVIP, "U.S. Nuclear Regulatory Commission Approval Letter for 'BWRVIP-100, Revision 1-A: BWR Vessel and Internals Project, Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds, EPRI Technical Report 3002008388' (CAC No. MF9359)," dated April 28, 2017 (ML17065A000)
22. NUREG-0619, Revision 1, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)," dated November 1980 (ML031600712)
23. NEI 03-08, Revision 3, "Guideline for Management of Material Issues," dated February 2017 (Accession No. ML19079A256)

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Table 1
Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1
and B-N-2 Requirements⁽¹⁾ to BWRVIP Guidance Requirements

ASME Item No. Table IWB-2500-1	Component	ASME Exam Scope	ASME Exam Type	ASME Frequency	Applicable BWRVIP Document	BWRVIP Exam Scope	BWRVIP Exam Type	BWRVIP Frequency
B13.10	Reactor Vessel Interior	Areas of the RPV above and below the core made accessible during a normal refuel.	VT-3	Each Period	None	While there is not a specific BWRVIP guideline that addresses the scope of B-N-1, the examinations performed by BWRVIP-18, 25, 26, 27, 41, 47, and 138 provide a general overview of the reactor interior which TVA considers to be representative of the B-N-1 scope.		
B13.20	Interior Attachments Within Beltline - Riser Braces	Accessible Welds	VT-1	Each 10-year Interval	BWRVIP-48-R2, Table 3-1 BWRVIP-41, R4-A	Riser Brace Attachment	EVT-1	25% during each subsequent 12 years
	Lower Surveillance Specimen Holder Brackets				BWRVIP-48-R2, Table 3-1	Bracket Attachment	VT-1	Each 10-Year Interval
B13.30	Interior Attachments Beyond Beltline - Steam Dryer Hold-Down Brackets	Accessible Welds	VT-3	Each 10-year interval	BWRVIP-48-R2, Table 3-1	Bracket Attachment	VT-3	Each 10-Year Interval
	Guide Rod Brackets				BWRVIP-48-R2, Table 3-1	Bracket Attachment	VT-3	Each 10-Year Interval
	Steam Dryer Support Brackets				BWRVIP-48-R2, Table 3-1	Bracket Attachment	EVT-1	100% every 12 Years
	Feedwater Sparger Brackets				BWRVIP-48-R2, Table 3-1	Bracket Attachment	VT-3	Each 10-Year Interval

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Table 1
Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1
and B-N-2 Requirements⁽¹⁾ to BWRVIP Guidance Requirements

ASME Item No. Table IWB-2500-1	Component	ASME Exam Scope	ASME Exam Type	ASME Frequency	Applicable BWRVIP Document	BWRVIP Exam Scope	BWRVIP Exam Type	BWRVIP Frequency
	Core Spray Piping Brackets				BWRVIP-48-R2, Table 3-1 BWRVIP-18, R2-A, Table 3-1	Bracket Attachment	VT-3 / EVT-1	EVT-1, 100% every 10 years, note: VT-3 of hardware at same interval
	Upper Surveillance Specimen Holder Brackets				BWRVIP-48-R2, Table 3-1	Bracket Attachment	VT-3	Each 10-Year Interval
	Shroud Support (Weld H9)				BWRVIP-38, 3.1.3.2, Figures 3-2 and 3-5	Weld H-9	EVT-1 or ultrasonic testing (UT)	Maximum of 6 years for EVT-1, Maximum of 10 years for UT
B13.40	Integrally Welded Core Support Structure	Accessible Surfaces	VT-3	Each 10-year interval	BWRVIP-38, 3.1.3.2, Figures 3-2 and 3-5	Shroud support welds H8 and H9 ⁽²⁾ including gussets	EVT-1 or UT	Based on as-found conditions, to a maximum 6 years for one side EVT-1, 10 years for UT where accessible
	Core Shroud Horizontal Welds				BWRVIP-76-R1-A, 2.2	Welds H1-H7 as applicable	EVT-1 or UT	Based on as-found conditions, to a maximum of 10 years for UT when inspected from both sides of the welds

**Table 1
Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1
and B-N-2 Requirements⁽¹⁾ to BWRVIP Guidance Requirements**

ASME Item No. Table IWB-2500-1	Component	ASME Exam Scope	ASME Exam Type	ASME Frequency	Applicable BWRVIP Document	BWRVIP Exam Scope	BWRVIP Exam Type	BWRVIP Frequency
	Core Shroud Vertical Welds				BWRVIP-76-R1-A, 2.3	Vertical Welds as applicable	EVT-1 or UT	Maximum 10 years for UT based on inspection of horizontal welds
	Core Shroud Repairs⁽²⁾				BWRVIP-76-R1-A, 3.5	Tie-Rod Repair	VT-3	In accordance with designer recommendations per BWRVIP-76-R1-A

Notes:

- (1) This table provides only an overview of the requirements. For more details, refer to ASME Code Section XI, Table IWB-2500-1 and the appropriate BWRVIP Document.
- (2) No repairs have been performed on the core shroud.

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Table 2 BWRVIP Guidelines Used for Section XI Code Examinations (Part of this Request)	
Document Number	Document Title
BWRVIP-03	“Reactor Pressure Vessel and Internals Examination Guidelines”
BWRVIP-06	“Safety Assessment of BWR Reactor Internals”
BWRVIP-14	“Evaluation of Crack Growth in Boiling Water Reactor Stainless Steel Reactor Pressure Vessel Internals”
BWRVIP-18	“BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines”
BWRVIP-25	“BWR Core Plate Inspection and Flaw Evaluation Guidelines”
BWRVIP-26	“BWR Top Guide Inspection and Flaw Evaluation Guidelines”
BWRVIP-27	“BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines”
BWRVIP-38	“BWR Shroud Support Inspection and Flaw Evaluation Guidelines”
BWRVIP-41 ⁽¹⁾	“BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines”
BWRVIP-47	“BWR Lower Plenum Inspection and Flaw Evaluation Guidelines”
BWRVIP-48 ⁽²⁾	“Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines”
BWRVIP-49	“Instrument Penetrations Inspection and Flaw Evaluation Guidelines”
BWRVIP-62	“Volume 2: Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection”
BWRVIP-74	“BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal”
BWRVIP-76 ⁽³⁾	“BWR Core Shroud Inspection and Flaw Evaluation Guidelines”
BWRVIP-94	“Program Implementation Guide”
BWRVIP-100 ⁽³⁾	“Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds”
BWRVIP-138 ⁽⁴⁾	“Updated Jet Pump Beam Inspection and Flaw Evaluation Guidelines”
BWRVIP-180	“Access Hole Cover Inspection and Flaw Evaluation Guidelines”
BWRVIP-183	“Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines”

Notes:

- (1) TVA Letter to NRC, DD-2022-01, “Boiling Water Reactor Vessel Internals Project (BWRVIP) – Notification of Deviation from BWRVIP-41, Revision 4-A, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines,” dated March 1, 2023 (ML23060A478)
- (2) Currently, there are no existing BWRVIP guidelines or ASME Section XI Code requirements regarding the feedwater spargers, except for BWRVIP-48-R2 which governs inspection of the reactor vessel internal attachment welds, namely the feedwater sparger brackets. BFN Units 1, 2, and 3 will continue to use NUREG-0619 for the feedwater sparger piping, spacer brackets, pins, end brackets, flow holes, and sparger tee welds outside of this request.
- (3) Due to potential non-conservatism identified concerning the BWRVIP-100 R1-A fracture toughness relationship as a function of neutron fluence (EPRI Letter 2021-016 and 2021-028), TVA has employed the expertise of a specialized vendor to perform shroud flaw evaluations and does not currently utilize associated guidance in BWRVIP-100 R1-A or affected documents/products BWRVIP-235, BWRVIP-76 R2, or EPRI Letter 2016-030 to assess flaws on the shroud applicable to the identified issue.
- (4) TVA Letter to NRC, DD-2023-01, “Boiling Water Reactor Vessel Internals Project (BWRVIP) – Notification of Deviation from BWRVIP-138, Revision 1-A, Updated Jet Pump Beam Inspection and Flaw Evaluation Guidelines,” dated April 3, 2023 (ML23093A211)

Attachment to 0-ISI-47**Comparison of Code Examination Requirements to BWRVIP Examination Requirements**

The following discussion provides a comparison of the examination requirements provided in ASME Code Item Numbers B13.10, B13.20, B13.30, and B13.40 in Table IWB-2500-1, to the examination requirements in the BWRVIP guidelines. Specific BWRVIP guidelines are provided as examples for comparisons. This comparison also includes a discussion of the examination methods.

1. Code Requirement - B13.10 - Reactor Vessel Interior Accessible Areas (B-N-1)

The ASME Code Section XI requires a VT-3 examination of reactor vessel accessible areas, which are defined as the spaces above and below the core made accessible during normal refueling outages. The frequency of these examinations is specified as the first refueling outage, and at intervals of approximately 3 years, during the first inspection interval, and each period during each successive 10-year inspection interval. Typically, these examinations are performed every other refueling outage of the inspection interval. This examination requirement is a non-specific requirement that is a departure from the traditional Section XI examinations of welds and surfaces. As such, this requirement has been interpreted and satisfied differently across the domestic fleet. The purpose of the examination is to identify relevant conditions such as distortion or displacement of parts; loose, missing, or fractured fasteners; foreign material, corrosion, erosion, or accumulation of corrosion products; wear; and structural degradation.

Portions of the various examinations required by the applicable BWRVIP guidelines listed in this request require access to accessible areas of the reactor vessel during each refueling outage. Examination of core spray piping and spargers (BWRVIP-18, Revision 2-A), top guide (BWRVIP-26-A), jet pump welds and components (BWRVIP-41, Revision 4-A), interior attachments (BWRVIP-48, Revision 2), core shroud welds (BWRVIP-76, Revision 1-A), shroud support (BWRVIP-38) and lower plenum components (BWRVIP-47-A) provides such access. Locating and examining specific welds and components within the reactor vessel areas above, below (if accessible), and surrounding the core (annulus area) entails access by remote camera systems that essentially perform equivalent VT-3 examination of these areas or spaces as the specific weld or component examinations are performed. This provides an equivalent method of visual examination on a more frequent basis than that required by the ASME Code Section XI. Evidence of wear, structural degradation, loose, missing, or displaced parts, foreign materials, and corrosion product buildup can be, and has been observed during the course of implementing these BWRVIP examination requirements.

No inspections of the lower plenum are currently planned for the third ISI interval at BFN Unit 1. Due to repairs on the BFN Unit 2 access hole cover, BFN Unit 2 completed lower plenum VT-3 inspections during the U2R22 refueling outage in the spring of 2023. Due to repair of the BFN Unit 3 access hole cover, BFN Unit 3 intends to examine the lower plenum during the U3R21 refueling outage in the spring of 2024. During normal refueling outages, BFN Units 1, 2, and 3 lower plenum components are not accessible. They are only accessible in limited areas when special maintenance activities are performed such as removal of guide tubes and jet pump assemblies.

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.

Therefore, the specified BWRVIP guideline requirements meet or exceed the subject Code requirements for examination method and frequency of the interior of the reactor vessel. Accordingly, these BWRVIP examination requirements provide an acceptable level of quality and safety as compared to the subject Code requirements.

2. Code Requirement - B13.20 - Interior Attachments Within the Beltline Region (B-N-2)

The ASME Code Section XI requires a VT-1 examination of accessible reactor interior surface attachment welds within the beltline each 10-year interval. In the boiling water reactor, this includes the jet pump riser brace welds-to-vessel wall and the lower surveillance specimen support bracket welds-to-vessel wall. In comparison, the BWRVIP requires the same examination method and frequency for the lower surveillance specimen support bracket welds and requires an enhanced VT-1 (EVT-1) examination on the remaining attachment welds in the beltline region in the first 12 years, and then 25 percent during each subsequent 12 years.

The jet pump riser brace examination requirements are provided below to show a comparison between the Code and the BWRVIP examination requirements.

Comparison to BWRVIP Requirements - Jet Pump Riser Braces (BWRVIP-41, Revision 4-A and BWRVIP-48, Revision 2)

- The ASME Code requires a 100 percent VT-1 examination of the jet pump riser brace-to-vessel wall pad welds each 10-year interval.
- The BWRVIP requires an EVT-1 examination of 25 percent of the jet pump riser brace-to-vessel wall pad welds (vessel ID attachment weld heat affected zones) on the vessel side of the welds every 12 years.
- BWRVIP-48, Revision 2 specifically defines the susceptible regions of the attachment that are to be examined.

The ASME Code Section XI, VT-1 examination is conducted to detect discontinuities and imperfections on the surfaces of components, including such conditions as cracks, wear, corrosion, or erosion. The BWRVIP EVT-1 is conducted to detect discontinuities and imperfections on the surface of components and is additionally specified to detect potentially very tight cracks characteristic of fatigue and inter-granular stress corrosion cracking (IGSCC), the relevant degradation mechanisms for these components. General wear, corrosion, or erosion, although generally not a concern for inherently tough, corrosion-resistant stainless steel material, would also be detected during the process of performing a BWRVIP EVT-1 examination.

The ASME Code Section XI, 2007 Edition with the 2008 Addenda, requires that a VT-1 visual examination method be able to identify a letter character with a height of 0.044 inches. The BWRVIP EVT-1 visual examination method requires the same 0.044 inch resolution on the examination surface and additionally the performance of a cleaning assessment and cleaning as necessary. While the jet pump riser brace configuration varies depending on the vessel manufacturer, (BWRVIP-48, Revision 2) includes diagrams for each configuration and prescribes examination for each configuration.

The resolution standards used for BWRVIP EVT-1 exams utilize the same Code characters, thus assuring at least equivalent resolution compared to the Code. Although the BWRVIP examination may be less frequent, it is a more comprehensive method. Therefore, the enhanced flaw detection capability of an EVT-1, with a less frequent examination schedule provides an acceptable level of quality and safety to that provided by the ASME Code.

3. Code Requirement - B13.30 - Interior Attachments Beyond the Beltline Region (B-N-2)

The ASME Code Section XI requires a VT-3 examination of accessible reactor interior surface attachment welds beyond the beltline each 10-year interval. In the boiling water reactor, this includes the core spray piping primary and supplemental support bracket welds-to-vessel wall, the upper surveillance specimen support bracket welds-to-vessel wall, the feedwater sparger support bracket welds-to-vessel wall, the steam dryer support and hold-down bracket welds-to-vessel wall, the guide rod support bracket weld-to-vessel wall, the shroud support plate-to-vessel wall, and shroud support gussets. BWRVIP-48, Revision 2 requires, as a minimum, the same VT-3 examination method as the Code for some of the interior attachment welds beyond the beltline region, and in some cases specifies an enhanced visual examination technique EVT-1 for these welds. For those interior attachment welds that have the same VT-3 method of examination, the same scope of examination (accessible welds), the same examination frequency (each 10 year interval), and ASME Code Section XI flaw evaluation criteria, the level of quality and safety provided by the BWRVIP requirements are equivalent to that provide by the ASME Code.

For the core spray support bracket attachment welds, the steam dryer support bracket attachment welds, and the shroud support plate-to-vessel welds, as applicable, the BWRVIP guidelines require an EVT-1 examination at the same frequency as the Code or at a more frequent rate. The feedwater sparger support bracket attachment welds receive a VT-3 examination (BWRVIP-48, Revision 2). Therefore, the BWRVIP requirements provide the same level of quality and safety to that provided by the ASME Code.

The core spray piping bracket-to-vessel attachment weld is used as an example for comparison between the Code and BWRVIP examination requirements as discussed below.

Comparison to BWRVIP Requirements - Core Spray Piping Bracket Welds (BWRVIP-48, Revision 2 and BWRVIP-18, Revision 2-A for Core Spray)

- The ASME Code examination requirement is a VT-3 examination of each weld every 10 years.
- The BWRVIP examination requirement is an EVT-1 inspection of 100 percent of the primary and supplemental core spray piping bracket-to-vessel ID attachment welds and heat-affected zones on both the vessel and bracket sides of the welds every 10 years. The BWRVIP examination method EVT-1 has superior flaw detection and sizing capability, the examination frequency is the same as the Code requirements, and the same flaw evaluation criteria are used.

- The ASME Code VT-3 examination is conducted to detect component structural integrity by ensuring the components general condition is acceptable. An enhanced EVT-1 is conducted to detect discontinuities and imperfections on the examination surfaces, including such conditions as tight cracks caused by IGSCC or fatigue, the relevant degradation mechanisms for BWR internal attachments.

Therefore, with the EVT-1 examination method, the same examination scope (accessible welds), the same flaw evaluation criteria (Section XI), the level of quality and safety provided by the BWRVIP criteria is superior to that required by the Code.

4. Code Requirement - B13.40 - Integrally Welded Core Support Structures (B-N-2)

The ASME Code Section XI requires a VT-3 examination of accessible surfaces of the welded core support structure each 10-year interval. In the boiling water reactor, the welded core support structure has primarily been considered the shroud support structure, including the shroud support plate (annulus floor), the shroud support ring, the shroud support welds, and the shroud support gussets. In later designs, the shroud itself is considered part of the welded core support structure. Historically, this requirement has been interpreted and satisfied differently across the industry. The proposed alternate examination replaces this ASME requirement with specific BWRVIP guidelines that examine susceptible locations for known relevant degradation mechanisms.

- The Code requires a VT-3 of accessible surfaces each 10-year interval.
- The BWRVIP requires as a minimum the same examination method (VT-3) as the Code for integrally welded core support structures, and for specific areas, requires either an enhanced visual examination technique (EVT-1) or UT volumetric examination.

BWRVIP recommended examinations of integrally welded core support structures are focused on the known susceptible areas of this structure, including the welds and associated weld heat affected zones. As a minimum, the same or superior visual examination technique is required for examination at the same frequency as the Code examination requirements. In many locations, the BWRVIP guidelines require a UT of the susceptible welds at a frequency identical to the Code requirement.

For other integrally welded core support structure components, the BWRVIP requires an EVT-1 or UT of core support structures. The core shroud is used as an example for comparison between the Code and BWRVIP examination requirements as shown below.

Comparison to BWRVIP Requirements - BWR Core Shroud Examination and Flaw Evaluation Guideline (BWRVIP-76, Revision 1-A)

- The ASME Code requires a VT-3 examination of accessible surfaces every 10 years.
- The BWRVIP requires an EVT-1 examination from the inside and outside surface where accessible or ultrasonic examination of each core shroud circumferential weld that has not been structurally replaced with a shroud repair at a calculated “end of interval” that will vary depending upon the amount of flaws present, but not to exceed ten years.

The BWRVIP recommended examinations specify locations that are known to be vulnerable to BWR relevant degradation mechanisms rather than “all surfaces.” The BWRVIP examination methods (EVT-1 or UT) are superior to the Code required VT-3 for flaw detection and characterization.

Enclosure

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The BWRVIP examination frequency is equivalent to or more frequent than the examination frequency required by the Code. The superior flaw detection and characterization capability, with an equivalent or more frequent examination frequency and the comparable flaw evaluation criteria, results in the BWRVIP criteria providing a level of quality and safety equivalent to or superior to that provided by the Code requirements.