



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

CNL-20-019

February 28, 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, American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Inservice Inspection and Augmented Program Interval Request for Alternative 0-ISI-47**

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 request to use an alternative 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 (B&PV) Code, 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 (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 B&PV Code, Section XI, and in many instances include components that are not part of the ASME B&PV Code, Section XI, jurisdiction.

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Enclosure 1 to this letter provides relief request 0-ISI-47 that requests the use of an alternative to the requirements of the ASME B&PV Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," ASME Code Class 1. Enclosure 1 provides the basis as to how the alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1). An attachment to the enclosure provides a comparison of the ASME and BWRVIP requirements.

TVA requests approval of this alternative by September 18, 2020, to allow for outage scheduling.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Kimberly D. Hulvey at 423-751-3275.

Respectfully,



James T. Polickoski  
Director, Nuclear Regulatory Affairs

Enclosure:

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

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 (BFN) UNITS 1, 2, AND 3  
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI, INSERVICE  
INSPECTION (ISI) AND AUGMENTED PROGRAM INTERVAL 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 ASME Section XI Code Requirements on Reactor Pressure Vessel 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 Reactor Pressure Vessel. 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 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), TVA is requesting NRC approval of a proposed 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.

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 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.

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 safety evaluations (SEs) for many of these Guidelines (References 2, 4 – 14 and 16).

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-A, Section 3.2.1). Future examinations of the RPV Vessel Attachment Welds will meet the inspection strategy in Section 3 of BWRVIP-48-A and BWRVIP-38.

The BWRVIP provides BWR Vessel and Internals Inspection Summaries to the NRC periodically. Table 3 contains the BWR Vessel and Internals Inspection Summaries transmitted to the NRC for the most recent BFN Units 1, 2, and 3 outages. These summaries provide, on a component-by-component basis, the examination methods utilized, the examination frequency to date, and the results of the examinations during the previous refueling outage. These summaries also contain the identified corrective actions and reflect the compilation of the BWRVIP outage reports. Those corrective actions and examinations that were performed prior to the BWRVIP were implemented to the requirements of ASME Section XI, as applicable.

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 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. 'NRC approved' generally means the document was submitted to the NRC for review and approval and a final Safety Evaluation (SE) has been issued and is to be incorporated into a publication of a '-A' document or equivalent."

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.

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 three active deviations. One for the core plate bolting under BWRVIP-25 for all three units. This deviation was resubmitted to the BWRVIP and the NRC to extend its interval of applicability until the revised BWRVIP-25 is approved by the NRC or some other NRC approved solution is implemented. A second deviation exists for a jet pump repair clamp on Jet Pump 5 on Unit 3, and a third deviation exists for a variance from BWRVIP Inspection and Examination guidelines for examination of jet pump holddown 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-R1-A, "BWR Vessel and Internals Project, Safety Assessment of BWR Internals" (Reference 2), which has been approved by the NRC. As a result of BWRVIP-06-R1-A, component-specific BWRVIP guidelines were developed providing appropriate examination and evaluation requirements to address the specific component safety function and potential degradation mechanism.

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:

- 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 (Accession No. ML19011A010).
- FirstEnergy Nuclear Operating Company, “Perry Nuclear Power Plant, Unit 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 (Accession No. ML18023A625).
- Nine Mile Point Nuclear Station, 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 (Accession No. ML18318A275).
- 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-008),” dated November 16, 2018 (Accession No. ML18310A013).
- Cooper Nuclear Station, “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 (Accession No. ML18183A325).
- Peach Bottom Atomic Power Station 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 L-2018-LLR-0056),” July 18, 2018, (Accession No. ML18179A394).
- FitzPatrick Nuclear Power Plant, “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. BWRVIP Letter to NRC, dated February 8, 2017, containing “BWRVIP-03, Revision 19: BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines,” EPRI Technical Report 3002008095. Provided to USNRC for INFORMATION ONLY as this report is updated periodically, (Accession No. ML17054C666).
2. 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 (Accession No. ML110341414).

3. BWRVIP Letter to NRC, "BWRVIP-14NP-A: BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Stainless Steel RPV Internals," (ADAMS Accession No. ML101880724), dated January 31, 2009, and Re-transmitted to NRC on May 12, 2009, as BWRVIP-14-A, (Accession No. ML091390008).
4. NRC Letter to BWRVIP, "Final Safety Evaluation for Electric Power Research Institute Topical Report 'BWRVIP-18, Revision 2: Boiling Water Reactor Vessel and Internals Project, Boiling Water Reactor Core Spray Internals Inspection and Flaw Evaluation Guidelines,' (TAC No. MF8809)," dated February 22, 2016 (Accession No. ML16011A190).
5. NRC Letter to BWRVIP, "Safety Evaluation of BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25)," dated December 19, 1999 (Accession Nos. ML993620267 and ML993620274).
6. 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 (Accession No. ML052490550).
7. NRC Letter to BWRVIP, "Non-Proprietary Version of NRC Staff Review of BWRVIP-27-A, 'BWR Standby Liquid Control System/Core Plate  $\Delta$ P Inspection and Flaw Evaluation Guidelines'," dated June 9, 2004 (Accession No. ML041700446).
8. 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 (Accession No. ML003735498).
9. BWR Vessels and Internals Project Report BWRVIP-41, Revision 3, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines," dated September 2010.
10. 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 (Accession No. ML052490537).
11. NRC Letter to BWRVIP, "NRC Approval Letter of BWRVIP-48-A, 'BWR Vessel and Internals Project Vessel ID Attachment Weld Inspection and Flaw Evaluation Guideline'," dated July 25, 2005 (Accession No. ML052130284).
12. 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 (Accession No. ML021510018).
13. BWRVIP Letter to NRC, "BWRVIP-74-A, 'BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal,'" dated June 18, 2003 (Accession No. ML031710343).
14. 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 (Accession No. ML15307A468).

15. BWRVIP Letter to NRC, "Project No. 704 - BWRVIP Program Implementation Guide (BWRVIP-94NP, Revision 2)," dated September 22, 2011 (Accession No. ML11271A058).
16. 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 (Accession No. ML17065A000).
17. 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 (Accession No. ML031600712).
18. NEI 03-08, Revision 3, "Guideline for Management of Material Issues," dated February 2017 (Accession No. ML19079A256).

**Table 1**  
**Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1**  
**and B-N-2 Requirements<sup>1</sup> 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, 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-R1, Table 3-2	Riser Brace Attachment	EVT-1	25% during each subsequent 6 years
	Lower Surveillance Specimen Holder Brackets				BWRVIP-48-R1, Table 3-2	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-R1, Table 3-2	Bracket Attachment	VT-3	Each 10-Year Interval
	Guide Rod Brackets				BWRVIP-48-R1, Table 3-2	Bracket Attachment	VT-3	Each 10-Year Interval
	Steam Dryer Support Brackets				BWRVIP-48-R1, Table 3-2	Bracket Attachment	EVT-1	Each 10-Year Interval
	Feedwater Sparger Brackets				BWRVIP-48-R1, Table 3-2	Bracket Attachment	EVT-1	Each 10-Year Interval
	Core Spray Piping Brackets				BWRVIP-48-R1, Table 3-2	Bracket Attachment	EVT-1	Each 10-Year Interval

**Table 1**  
**Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1**  
**and B-N-2 Requirements<sup>1</sup> 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
	Upper Surveillance Specimen Holder Brackets				BWRVIP-48-R1, Table 3-2	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 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 <sup>(2)</sup> 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	UT or EVT-1	Based on as-found conditions, to a maximum of 10 years for UT when inspected from both sides of the welds
	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

**Table 1**  
**Comparison of ASME Code Section XI Table IWB-2500-1 Examination Category B-N-1**  
**and B-N-2 Requirements<sup>1</sup> 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 Repairs <sup>(2)</sup>				BWRVIP-76- R1-A, 3.5	Tie-Rod Repair	VT-3	In accordance with designer recommendations per BWRVIP-76 R1

**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.

**Table 2**  
**BWRVIP Guidelines Used for Section XI Code Examinations**  
**(Part of this Request)**

<b>Document Number</b>	<b>Document Title</b>
BWRVIP-03	"BWR Vessel and Internals Project, Reactor Pressure Vessel and Internal Examination Guidelines"
BWRVIP-06	"BWR Vessel and Internals Project, Safety Assessment of BWR Internals"
BWRVIP-14	"BWR Vessel and Internals Project, BWR Evaluation of Crack Growth in BWR Stainless Steel RPV Internals"
BWRVIP-18	"BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines," (Licensee Renewal (LR) Safety Evaluation Report (SER) updated to Revision 2 in the annual update of May 9, 2016)
BWRVIP-25 <sup>(1)</sup>	"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 $\Delta P$ Inspection and Flaw Evaluation Guidelines"
BWRVIP-38	"BWR Shroud Support Inspection and Flaw Evaluation Guidelines"
BWRVIP-41 <sup>(2)</sup>	"BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines"
BWRVIP-47	"BWR Lower Plenum Inspection and Flaw Evaluation Guidelines"
BWRVIP-48 <sup>(4)</sup>	"Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines"
BWRVIP-49	"Instrument Penetration Inspection and Flaw Evaluation Guidelines"
BWRVIP-74	"BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines"
BWRVIP-76 <sup>(4)</sup>	"BWR Core Shroud Inspection and Flaw Evaluation Guidelines" (LR) SER updated to Revision 1-A in the annual update of May 9, 2016)
BWRVIP-94	"BWR Vessel and Internals Project Program Implementation Guide"
BWRVIP-100 <sup>(5)</sup>	"Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds"
BWRVIP-138 <sup>(3)</sup>	"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"

**Table 2**  
**BWRVIP Guidelines Used for Section XI Code Examinations**  
**(Part of this Request)**

**Notes:**

- (1) TVA submitted a letter to the NRC “Boiling Water Reactor Vessel Internals Project (BWRVIP) – Notification of Deviation from BWRVIP-25, BWR Core Plate Inspection and Flaw Evaluation Guidelines” dated 11/21/16 (ML16333A390).
- (2) TVA submitted a letter to the NRC “Boiling Water Reactor Vessel Internals Project (BWRVIP) – Notification of Deviation for BFN Unit 3 from BWRVIP-41-R4-A, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines” dated 10/22/19, (ML19295G582).
- (3) TVA submitted a letter to the NRC “Boiling Water Reactor Vessel Internals Project (BWRVIP) – Notification of Deviation for BFN Unit 3 from BWRVIP-138-R1-A, Updated Jet Pump Beam Inspection and Flaw Evaluation Guidelines” dated 2/16/17, (ML17047A708).
- (4) Currently, there are no existing BWRVIP guidelines or ASME Section XI Code requirements regarding the feedwater spargers except for BWRVIP-48-R1 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.
- (5) If flaw evaluations are required for BWRVIP-76-R1-A examinations, the fracture toughness values of BWRVIP-100, Revision 1-A will be utilized.

**Table 3**  
**BWR Vessel and Internals Inspection Summaries**

Unit	Accession Number	Document Title	Document Date
BFN 1	ML17187A190	Project No. 704 – BWR Vessel and Internals Inspection Summaries for Fall 2016 Outages	06/30/17
BFN 2	ML18040A464	Project No. 704 – BWR Vessel and Internals Inspection Summaries for Spring 2017 Outages	02/07/18
BFN 3	ML17304A944	Project No. 704 – BWR Vessel and Internals Inspection Summaries for Spring 2016 Outages	11/28/16
Note: the BWR Vessel and Internals Inspection Summary that includes the latest BFN Units 1, 2, and 3 outages has not been assembled and transmitted to the NRC by the BWRVIP, but will be submitted later.			

**Attachment 1 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-A-R2), Top Guide (BWRVIP-26-A), Jet Pump Welds and Components (BWRVIP-41-R3), Interior Attachments (BWRVIP-48-R1), Core Shroud Welds (BWRVIP-76-R1-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 performs 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.

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 6 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-R3 and BWRVIP-48-R1)

- The ASME Code requires a 100 percent VT-1 examination of the jet pump riser brace-to reactor-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-reactor vessel wall pad welds (vessel ID attachment weld heat affected zones) on the vessel side of the welds every 6 years.
- BWRVIP-48-R1 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-R1) 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-reactor vessel wall, the steam dryer support and hold down bracket welds-to-reactor vessel wall, the guide rod support bracket weld-to-reactor vessel wall, the shroud support plate-to-vessel wall, and shroud support gussets. (BWRVIP-48-R1) 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 provided by the ASME Code.

For the Core Spray support bracket attachment welds, the steam dryer support bracket attachment welds, the feedwater sparger 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. 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-R1)

- 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 greater than 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 volumetric examination (UT).

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 volumetric examination 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)

- 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” (EOI) 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.

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.