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10 CFR 50.55a

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

Brunswick Steam Electric Plant, Unit No. 1
Renewed Facility Operating License No. DPR-71
Docket No. 50-325

SUBJECT: Proposed In-service Inspection Alternative for Application of Dissimilar Metal Weld Full Structural Overlay – Nozzle N4D

Ladies and Gentlemen:

Pursuant to 10 CFR 50.55a(z)(1), Duke Energy Progress, LLC (Duke Energy) is proposing an In-service Inspection (ISI) alternative for the Brunswick Steam Electric Plant (BSEP), Unit No. 1. Specifically, Duke Energy is proposing to use the guidance of American Society of Mechanical Engineers (ASME) Code Case N-740-2, "Full Structural Dissimilar Metal Weld Overlay for Repair or Mitigation of Class 1, 2, and 3 Items," for application of a full structural weld overlay of the N4D feedwater nozzle dissimilar metal weld.

The proposed alternative is described in Enclosure 1. Enclosure 2 contains new regulatory commitments made in this submittal.

To support work in the BSEP Unit 1 refueling outage currently scheduled for March 2026, Duke Energy requests approval of this proposed alternative prior to that outage. If you have additional questions, please contact Ryan Treadway, Director – Nuclear Fleet Licensing, at 980-373-5873.

Sincerely,

Kevin M. Ellis
General Manager – Nuclear Regulatory Affairs, Policy & Emergency Preparedness

Enclosures:

1. In-service Inspection (ISI) Program Alternative, Full Structural Weld Overlay of N4D Feedwater Nozzle Dissimilar Metal Weld
   - Attachment 1: Proposed Alternative for N4D Feedwater Dissimilar Metal Weld Overlay
   - Attachment 2: Review of ASME Code Case N-740-2 against the Proposed Alternative Weld Overlay
2. List of Regulatory Commitments

cc:

L. Dudes, Regional Administrator USNRC Region II
G. Smith, NRC Senior Resident Inspector
L. Haeg, NRC Project Manager, NRR

Enclosure 1
In-service Inspection (ISI) Program Alternative, Full Structural Weld Overlay of N4D Feedwater Nozzle Dissimilar Metal Weld

10 Pages Follow

In-service Inspection (ISI) Program Alternative
Full Structural Weld Overlay of N4D Feedwater Nozzle Dissimilar Metal Weld

1. American Society of Mechanical Engineers (ASME) Code Component Affected

Component:	Feedwater Dissimilar Metal Weld (DMW)			
Code Class:	Class 1			
Weld Number:	**Examination Category (Note 1)**	**Description**	**Size**	**Materials (Note 2)**
1B21N4D-5-SW2-3 Unit 1	BWRVIP 75-A, Category F Risk Informed R1.11/R1.16	Nozzle N4D safe end transition to feedwater pipe transition (DM)	13.28" OD	Alloy 600 safe end transition; Alloy 82/182 weld; carbon steel pipe transition

Note 1 – This is currently Examination Category F. Once the weld overlay is installed, it will become Examination Category E.
Note 2 – Safe end transition – SB-166 UNS N06600 (P-No. 43)
Pipe transition – SA-106 Grade B (P-No. 1)
Alloy 82/182 weld – ERNiCr-3, Spec. SFA 5.14 / ENiCrFe-3, Spec. SFA 5.11 (Both F-No. 43)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Section XI – 2007 Edition with 2008 Addenda (i.e., Reference 1).

3. Applicable Code Requirement

IWA-4411 of the ASME Code, Section XI states:

Welding, brazing, fabrication, and installation shall be performed in accordance with the Owner's Requirements and, except as modified below, in accordance with the original Construction Code of the item.

IWA-4411(a) of the ASME Code, Section XI states in part:

Later Editions and Addenda of the Construction Code, or a later different Construction Code, either in its entirety or portions thereof, and Code Cases may be used, provided the substitution is as listed in IWA-4221(c).

IWA-4411(b) of the ASME Code, Section XI states:

Revised Owner's Requirements may be used, provided they are reconciled in accordance with IWA-4222.

ASME Code, Section XI, Appendix VIII, Supplement 11 (i.e., Reference 2) provides qualification requirements for the ultrasonic testing (UT) examination of Full Structural Overlaid Wrought Austenitic Piping Welds.

4. Reason for Proposed Alternative

Dissimilar metal welds (DMWs) containing nickel welding Alloys 82 and 182 have experienced stress corrosion cracking (SCC) in components operating at pressurized water and boiling water reactor temperatures (i.e., References 3, 8, and 9).

Duke Energy Progress, LLC (Duke Energy) proposes to mitigate the SCC susceptibility of the Brunswick Steam Electric Plant (BSEP), Unit 1 Feedwater nozzles N4D dissimilar metal weld, containing a known flaw, between the safe end transition and piping transition by installing a full structural weld overlay (FSWOL) on the DMW. This approach provides an alternative to replacement of the component, as a means of restoring full component integrity and assuring the structural integrity of this location.

Currently, there are no Nuclear Regulatory Commission (NRC) approved criteria for a licensee to apply a FSWOL to an Alloy 82/182 DMW. The edition and addenda of ASME Code, Section XI applicable to BSEP Unit 1 does not contain requirements for weld overlays. However, DMW overlays have been applied to other reactor pressure vessel (RPV) nozzle DMWs in boiling water reactors (BWRs) using alternative requirements, including BSEP Unit 2 in 2017 and BSEP Unit 1 in 2018. This request proposes to use the guidance of ASME Code Case
N-740-2 (i.e., Reference 4) for application of a full structural weld overlay of the N4D nozzle DMW at BSEP Unit 1. Since Code Case N-740-2 has not been approved by the NRC in the latest revision of Regulatory Guide (RG) 1.147, an alternative is required. This request describes the requirements Duke Energy proposes to use to design and install a FSWOL on the N4D nozzle DMW.

Indication Characterization

The indication in the N4D feedwater nozzle weld 1B21N4D-5-SW2-3 is circumferentially oriented and located within the weld zone, on the Alloy 600 safe end transition side of the joint. The circumferential indication is inside surface connected and exposed to the reactor coolant.

Weld Number:	Indication #	Circumferential Location (0 at Top Center)	Flaw Length	Flaw Depth	Nominal Remainent Ligament
1B21N4D-5-SW2-3	1	6.02” – 10.39”	4.37	0.306	0.815

Upon discovery, this flaw was evaluated and determined to meet ASME Section XI acceptance criteria with approximately 9.3 years of additional flaw growth. Subsequent

examinations have been preformed during each refueling outage with no measurable change in the flaw size.

5. Proposed Alternative and Basis for Use

Pursuant to 10 CFR 50.55a(z)(1), Duke Energy proposes an alternative to the ASME Code requirements stated above. The alternative and its proposed use are described in Attachment 1 to this request which includes installation of a FSWOL that structurally replaces the existing weld and defect. This alternative is based on the methodology contained in ASME Code Case N-740-2.

Ultrasonic examination procedures will be qualified in accordance with ASME Code Case N-653-2 (i.e., Reference 11). This case is approved for use in Table 1 of RG 1.147, Revision 21 (i.e., Reference 11) as an alternative to the requirements of ASME Code, Section VIII, Supplement 11.

Duke Energy plans to apply a full structural, Alloy 52M, overlay to the dissimilar metal Alloy 82/182 DMW identified in Section 1 and extend it over the adjacent similar metal welds as presented schematically in Figure 5-1, below.

Duke Energy understands that the installation of the FSWOL would limit future examination of the adjacent similar metal welds (i.e., Items 12 and 15 in Figure 5-1). Code Case N-740-2 addresses the ability to examine welds obstructed by a weld overlay in 1.2(b), which is permissive and states,

> If a weld overlay on any of the material combinations in (a) obstructs a required examination of an adjacent P-8 to P-8 weld, the overlay may be extended to include overlaying the adjacent weld.

The welds in question are joining P-No. 43 to P-No. 43 and P-No. 1 to P-No 1 materials, and the FSWOL design has been extended to cover them (see Figure 5-1). The FSWOL has been sized to allow for full 100% coverage of the examination volume (CC N-740-2) of the adjacent welds (Item 12 & 15).

The N4D nozzle FSWOL addressed by this alternative will require Ambient Temperature Temper Bead Welding as described in Code Case N-638-11, or post weld heat treatment (PWHT). Duke proposes to use the alternative of Code Case N-888-1 along with the NRC approved Code Case N-638-11. Code Case N-888-1 removes the requirement for a 48 hour hold prior to volumetric examination, if austenitic materials are involved. The basis for utilizing Code Case N-888-1 is discussed in Attachment 2 (e.g. the justification for Mandatory Appendix I).

Duke Energy proposes to use ASME Code Case N-740-2 as an alternative to the requirements specified in Section 3 of this request. Code Case N-740-2 has been approved by the ASME Code Committee to specifically allow FSWOLs on nickel alloy DMWs. However, ASME Code Case N-740-2 has not been accepted by the NRC in RG 1.147, Revision 21. Code Case N-740-2 provides the basis and requirements for the weld overlay techniques. The Code Case N-740-2 design requirements which are applicable to BSEP

Unit 1 are detailed in Attachment 1, and the implementation requirements that are applicable are detailed in Attachments 1 and 2.

Attachment 2 discusses the proposed alternative, Code Case N-740-2 and Appendix Q (from the 2007 Edition with the 2008 Addenda).

The proposed alternative provides an acceptable methodology for mitigating SCC, and for mitigating the defect that was detected in the identified weld to acceptable Code requirements and margins. The use of weld overlay filler metals that are resistant to SCC (e.g., Alloy 52/52M), weld overlay procedures that create compressive residual stress profiles within the original weld, and post overlay preservice and inservice inspection requirements provide assurance that structural integrity will be maintained for the remaining service life of the weld. Crack growth evaluations for SCC and fatigue of a bounding postulated flaw will demonstrate that structural integrity of the component, with the FSWOL in place, will be maintained for the remaining service life of the component.

The use of this alternative is requested on the basis that the proposed requirements will provide an acceptable level of quality and safety.

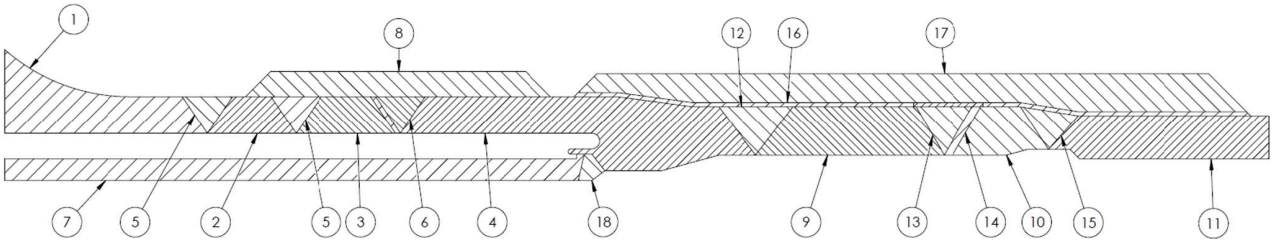
Schematic Configuration for the FSWOL

A representation of the FSWOL for the N4D nozzle DMW configuration is presented schematically in Figure 5-1 below.

RPV Feedwater Nozzle Dissimilar Metal Weld

The RPV Feedwater N4 nozzles are low alloy steel nozzles that, through a series of welds, are joined to the feedwater piping system. Within the series of welds, an Alloy 600 safe end transition is joined to a carbon steel piping transition. The piping transition is buttered with Alloy 82/182 weld material and subsequently joined to the Alloy 600 safe end transition.

Figure 5-1 Schematic Configuration for the N4D Nozzle with FSWOL



	Parts List	Material	ASME IX P-No.
1.	Nozzle	SA-508 Class 2	3
2.	Old Safe End Stub	SA-508 Class 1	1
3.	Safe End Extension	SA-508 Class 1	1
4.	Safe End	SB-166 UNS N06600	43
5.	Low Alloy or Carbon to Carbon Steel Weld	SFA-A5.1 E8018G, parts 1 to 2 Carbon steel, parts 2 to 3	--
6.	DMW and Butter	SFA 5.14 ERNiCr-3 / SFA 5.11 ENiCrFe-3 (Alloy 82/182)	---
7.	Thermal Sleeve	SB-564 UNS N06600	43
8.	Existing FSWOL	SFA-A5.14 ERNiCrFe-7a (Alloy 52M)	--
9.	Safe End Transition	SB-166 UNS N06600	43
10.	Pipe Transition	SA-106 Grade B	1
11.	Feedwater Piping	SA-333 Grade 6	1
12.	Safe End to Safe End Transition Weld	Alloy 52	--
13, 14.	Safe End Transition to Pipe Transition DMW and Butter	SFA 5.14 ERNiCr-3 / SFA 5.11 ENiCrFe-3 (Alloy 82/182)	--
15.	Pipe Transition to Feedwater Piping Weld	Carbon Steel	--
16.	Buffer Layer(s)	Alloy 82	--
17.	New FSWOL	SFA-A5.14 ERNiCrFe-7a (Alloy 52M)	--
18.	Thermal Sleeve Weld	Alloy 82/182	---

Suitability of Proposed Post Overlay Nondestructive Examination (NDE)

As part of the design of the FSWOL, the FSWOL length, surface finish, and flatness are specified to allow for post-installation, qualified ASME Code, Section XI, Appendix VIII UT examinations, as implemented through Code Case N-653-2. These examinations include the FSWOL and the required volume of the base material and original weld underneath the FSWOL. The examinations specified in this proposed alternative provide adequate assurance of structural integrity for the following reasons:

- The UT examinations that will be performed with the proposed alternative will be qualified in accordance with ASME Code Case N-653-2, which has been accepted in RG 1.147, Rev 21, as an alternative to the requirements of ASME Code, Section XI, Appendix VIII, Supplement 11 (i.e., Reference 2) for qualification. These examinations are considered more sensitive for detection of defects, either from fabrication or service induced, than ASME Code, Section III radiography or UT methods. Further, construction flaws are included in the qualification sample sets for evaluating procedures and personnel.

- ASME Code, Section XI has specific acceptance criteria and evaluation methodology to be utilized with the results from these more sensitive UT examinations. The criteria consider the materials in which the flaw indications are detected, the orientation and size of the indications, and ultimately their potential structural effects on the component. The acceptance criteria include allowable flaw indication tables for planar flaws (i.e., Table IWB-3514-2) and for laminar flaws (i.e., Table IWB-3514-3).

- A laminar flaw is defined in ASME Code, Section XI as a flaw oriented within 10 degrees of a plane parallel to the surface of the component. This definition is applicable to welds, weld overlays, and base materials. The standard imposed for evaluating laminar flaws in ASME Code, Section XI is more restrictive than the Section III standard for evaluating laminations. The ASME Code, Section XI laminar flaw standards are contained in Table IWB-3514-3 of ASME Code, Section XI, and are supplemented in Attachment 1. These criteria require that the sum of laminar flaw lengths in any direction must be less than 10 percent of the overlay length, with a total reduction in area equal to or less than specified in Table IWB-3514-3. For weld overlay areas where examination is precluded by the presence of the flaw, the areas must be postulated to be cracked.

- Any planar flaws found in the FSWOLs during either the weld overlay acceptance or preservice examinations are required to meet the preservice standards of ASME Code, Section XI, Table IWB-3514-2. In applying the planar flaw standards, the thickness of the component must be defined as the thickness of the FSWOL, and the issue of any flaws masked from examination must also be addressed as a part of the proposed alternative.

- Weld overlays for repair of cracks in piping are not addressed by ASME Code, Section III. ASME Code, Section III utilizes NDE procedures and techniques with flaw

detection capabilities that are within the practical limits of workmanship standards for welds. These standards are most applicable to volumetric examinations conducted by radiographic examination. Radiography (RT) of weld overlays is not practical because of the presence of radioactive material in the reactor coolant system and water in the pipe. The ASME Code, Section III acceptance standards are written for a range of fabrication flaws, including lack of fusion, incomplete penetration, cracking, slag inclusions, porosity, and concavity. However, experience and fracture mechanics have demonstrated that many of the flaws that would be rejected using ASME Code, Section III acceptance standards do not have a significant effect on the structural integrity of the component. The proposed alternatives in Attachments 1 and 2 were written to specifically address weld overlays, and not only do these alternatives adequately examine the weld overlay, but also provide appropriate examinations and acceptance criteria.

The ASME Code, Section XI acceptance standards are the logical choice for evaluation of potential flaw indications in post-overlay examinations, in which unnecessary repairs to the overlays would result in additional personnel radiation exposure and could potentially degrade the effectiveness of the overlays by affecting the favorable residual stress field that they produce. The criteria are consistent with previous criteria approved by the NRC for weld overlay installations. Weld overlays have been used for repair and mitigation of cracking in BWRs for many years. In NRC Generic Letter 88-01, *NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping*, the NRC approved the use of ASME Code, Section XI inspection procedures for determining the acceptability of installed weld overlays in BWR reactor coolant pressure boundary piping. In addition, the NRC has conditionally accepted ASME Code Case N-504-4 in RG 1.147, Revision 21. ASME Code Case N-504-4 was developed to codify the BWR weld overlay experience, and NRC approval is consistent with the NRC acceptability of BWR weld overlays. Code Case N-740-2 has since been developed for use on DMWs.

The NRC found the use of the ASME Code, Section XI, Appendix VIII, Supplement 11 acceptable for identifying both construction and service induced flaws in the Safety Evaluations (SE) for BSEP Unit 1 dated August 9, 2018 (ML18197A430); BSEP Unit 2 dated October 10, 2017 (ML17230A274); Millstone Power Station Unit 2 dated April 24, 2015 (ML15082A409); Edwin I. Hatch Nuclear Plant, Unit 1, dated December 18, 2015 (ML15349A973); and in a letter for James A. Fitzpatrick Nuclear Power Plant dated April 12, 2017 (ML17090A168). Associated with the identification of construction and service induced flaws is the use of associated ASME Code, Section XI acceptance criteria, Tables IWB-3514-2 and IWB-3514-3. The NRC accepted the use of ASME Code, Section XI acceptance standards (which contain IWB-3500 criteria) in an SE dated July 21, 2004 (ML041670510), for the Three Mile Island Plant, for disposition of flaws identified in a weld overlay by Performance Demonstration Initiative (PDI) qualified ultrasonic examinations, based on an earlier revision of Code Case N-653, with additional restrictions similar to those proposed herein for regions in which inspection is precluded by the flaws.

Need for Ambient Temperature Temper Bead Techniques

The N4D nozzle FSWOL addressed by this alternative will require Ambient Temperature Temper Bead Welding as described in Mandatory Appendix I of Code Case N-740-2, Code Case N-638-11, or post weld heat treatment (PWHT).

Analyses and Verifications

The following list of analyses and verifications will be performed subject to the specific design, analysis, and inspection requirements that have been defined in this relief request.

1. The as-built dimensions of the FSWOL will be measured and evaluated to demonstrate that they equal or exceed the minimum design dimensions of the overlay design.

2. Overall component shrinkage will be measured after the weld overlay application for the N4D nozzle. The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, and changes in system flexibility and weight due to the weld overlay) shall be evaluated. Existing flaws previously accepted by analytical evaluation shall be evaluated in accordance with IWB-3640, IWC-3640, or IWD-3640, as applicable.

3. Nozzle specific stress analyses will be performed to establish a residual stress profile in the N4D nozzle. Inside diameter (ID) weld repairs will be assumed in these analyses to effectively bound any actual weld repairs that may have occurred in the nozzle. The analysis will then simulate application of the FSWOL to determine the final residual stress profiles. Post weld overlay residual stresses at normal operating conditions will be shown to result in an improved stress state at the ID of the N4D nozzle weld region that reduces the probability for further crack propagation due to SCC.

4. The analyses will demonstrate that the application of the FSWOL satisfies all ASME Code, Section III stress and fatigue criteria.

5. Fracture mechanics analyses will be performed to predict crack growth. Crack growth due to SCC and fatigue crack growth in the original DMW will be evaluated. These crack growth analyses will consider all design loads and transients, plus the post weld overlay through-wall residual stress distributions and will demonstrate that the assumed cracks will not grow beyond the design bases for the weld overlay.

6. The impact of the added weight and stiffness on the piping system due to the overlay will be evaluated for potential impact on RPV nozzle stresses and dynamic characteristics.

The following information will be submitted to the NRC within 120 days of the completion of refueling outage B1R26, which is scheduled for March 2026.

1. A listing of indications detected in the full structural weld overlay material.

2. A description of any repairs to the full structural weld overlay material and the reason for the repair.

3. The disposition of all indications using the acceptance criteria of ASME Code, Section XI, IWB-3514.

4. A summary of the residual stress, crack growth analysis and ASME code, Section XI evaluation.

Conclusions

Quality and Safety of Proposed Alternative

Implementation of the FSWOL alternative described in Attachments 1 and 2 of this request produces an effective repair for future mitigation of SCC in the identified weld and maintains the nozzle geometry to permit future ASME Code, Section XI, Appendix VIII UT examinations as implemented through Code Case N-653-2. FSWOL repairs of DMWs have been installed and performed successfully for many years in both PWR and BWR applications. The alternative provides improved structural integrity and reduces the likelihood of leakage at the N4D nozzle location. Accordingly, the use of the alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

6. Duration of Proposed Alternative

The provisions of this alternative are applicable to the fifth 10-year in-service inspection interval for BSEP, which commenced on May 11, 2018, and will end on May 10, 2028.

The FSWOL for the N4D nozzle, installed in accordance with the provisions of this alternative, will remain in place for the design life of the repair established as described in Attachments 1 and 2.

7. Precedents

1. A similar relief request to use the guidance of Code Case N-740-2 was the Brunswick Steam Electric Plant, Unit 2 relief request dated April 6, 2017 (ML17096A619). The NRC Safety Evaluation was subsequently issued on October 10, 2017 (ML17230A274).
2. A similar relief request to use the guidance of Code Case N-740-2 was the Brunswick Steam Electric Plant, Unit 1 relief request dated March 19, 2018 (ML18078A804). The NRC Safety Evaluation was subsequently issued on August 9, 2018 (ML18197A430).
3. A similar relief request to utilize Code Case N-888-1 was the Nine Mile Point, Unit 1 relief request dated March 30, 2023 (ML23089A230), including reference to the supporting White Paper, 2023 PVP Conference Proceedings in July 2023, PVP2023-107489. The NRC Safety Evaluation was subsequently issued on June 22, 2023 (ML23156A682). Similar Commitments are proposed in this relief request, with the exception of a 120-day

post outage due date instead of 60 days post outage, to align with the owner's ISI post-outage activity report.

8. References

1. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 2007 Edition with 2008 Addenda.

2. ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through 2003 Addenda, Appendix VIII, Supplement 11, *Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds*.

3. EPRI Materials Reliability Program Report: *Crack Growth Rates for Evaluating PWSCC of Alloy 82, 182, and 132 Welds (MRP-115)*, EPRI, Palo Alto, CA, and Dominion Engineering, Inc., Reston, VA: November 2004. 1006696.

4. ASME Code Case N-740-2, *Full Structural Dissimilar Metal Weld Overlay for Repair or Mitigation of Class 1, 2, and 3 Items*.

5. NUREG/CR-6907, *Crack Growth Rates of Nickel Alloy Welds in a PWR Environment*, U.S. Nuclear Regulatory Commission (Argonne National Laboratory), May 2006

6. EPRI Material Reliability Program Report: *Primary System Piping Butt Weld Inspection and Evaluation Guidelines (MRP-139)*, EPRI, Palo Alto, CA: August 2005. 1010087.

7. ASME Boiler and Pressure Vessel Code, Section III, *Rules for Construction of Nuclear Power Plant Components*, 1974 Edition with Addenda through Summer 1976

8. ASME Code Case N-504-4, *Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping*.

9. ASME Boiler and Pressure Vessel Code, Section XI, Nonmandatory Appendix Q, 2007 Edition through 2008 Addenda.

10. Regulatory Guide (RG) 1.147, Revision 21, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*.

11. ASME Code Case N-653-2, *Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds, Section XI, Division 1*.

12. *BWRVIP-75-A, BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules*, EPRI, Palo Alto, CA: 2005. 1012621.

Enclosure 1, Attachment 1
Proposed Alternative for N4D Feedwater Dissimilar Metal Weld Overlay

11 Pages Follow

Attachment 1

Proposed Alternative for N4D Feedwater Dissimilar Metal Weld Overlay

A1.1 INTRODUCTION

Duke Energy proposes the following detailed requirements for the design, analysis, fabrication, examination, and pressure testing of the BSEP Unit 1 Reactor Pressure Vessel (RPV) Feedwater nozzle N4D dissimilar metal weld overlay. These requirements, which are derived from applicable portions of ASME Code Case N-740-2, provide an acceptable methodology for reducing potential defects in these austenitic nickel alloy welds to an acceptable size and mitigating the potential for future stress corrosion cracking by increasing the wall thickness through deposition of a weld overlay. The weld overlay will be applied by deposition of weld reinforcement (i.e., weld overlay) on the outside surface of the safe end transition, pipe transition, and associated dissimilar metal weld, in accordance with the following requirements:

A1.2 GENERAL REQUIREMENTS (Correlated to N-740-2, paragraph 1)

A1.2.1 Definitions

(a) **Full structural weld overlay** - deposition of weld reinforcement on the outside diameter of the piping, component, or associated weld, such that the weld reinforcement is capable of supporting the design loads, without consideration of the piping, component, or associated weld beneath the weld reinforcement. Full structural weld overlay can be either mitigative or repair weld overlay as defined in A1.2.1(b) and (c).

(b) **Mitigative weld overlay** - weld overlay that is applied over material with no inside-surface-connected flaws found during an examination performed in accordance with A1.3(a)(3), prior to the weld overlay being applied.

(c) **Repair weld overlay** - weld overlay that is applied over material with an inside-surface-connected flaw or subsurface defect, or where a pre-weld overlay examination is not performed.

(d) **SCC susceptible materials** - for this proposed alternative, the stress-corrosion-cracking (SCC) susceptible materials are Unified Numbering System (UNS) N06600, N06082, or W86182 in pressurized water reactor environments; or the associated welds in UNS N06600, W86182, or austenitic stainless steels in boiling water reactor environments.

A1.2.2 General Overlay Requirements

(a) A full-structural weld overlay will be applied by deposition of weld reinforcement (i.e., weld overlay) on the outside surface of circumferential welds. This proposed method applies to austenitic nickel alloy and austenitic stainless steel welds between the following:

P-No. 8 or P-No. 43 and P-Nos. 1, 3, 12A, 12B, or 12C
P-No. 8 and P-No. 43
Between P-Nos. 1, 3, 12A, 12B, and 12C materials

(b) If a weld overlay on any of the material combinations in A1.2.2(a) obstructs a required examination of an adjacent P-No. 8 to P-No. 8 weld, the overlay will be extended to include overlaying the adjacent weld.

(c) Weld overlay filler metal will be austenitic nickel alloy (i.e., 28 percent chromium minimum, ERNiCrFe-7/7A) meeting the requirements of 1.2.2(e)(1) or (2), as applicable, applied 360 degrees around the circumference of the item and deposited using a Welding Procedure Specification (WPS) for groove welding, qualified in accordance with the Construction Code and Owner's Requirements identified in the Repair/Replacement Plan.

(d) Prior to deposition of the weld overlay, the surface to be weld overlaid will be examined using the liquid penetrant method. Indications with major dimensions greater than 1/16 inch (i.e., 1.5 millimeters) will be removed, reduced in size, or weld repaired in accordance with the following requirements:

(1) One or more layers of weld metal will be applied to seal unacceptable indications in the area to be repaired with or without excavation. The thickness of these layers will not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication prior to welding is permitted.

(2) If weld repair of indications identified in A1.2.2(d) is required, the area where the weld overlay is to be deposited, including any local weld repairs or initial weld overlay layer, will be examined by the liquid penetrant method. The area shall contain no indications with major dimensions greater than 1/16 inch (i.e., 1.5 millimeters) prior to application of the structural layers of the weld overlay.

(3) Per ASME Code Case N-740-2, to reduce the potential of hot cracking when applying an austenitic nickel alloy over P-No. 8 base metal, a layer or multiple layers of austenitic stainless steel filler material will be applied over the austenitic stainless steel base metal. The stainless steel filler metal shall have a delta ferrite content of 5 to 15 Ferrite Number (FN), as reported on the Certified Material Test Report. The thickness of these buffer layers will not be used in meeting weld reinforcement design thickness requirements.

Since a stainless steel buffer layer will not be applied for the BSEP Unit 1 N4D nozzle weld overlay, this stipulation of ASME Code Case N-740-2 will not apply.

Duke Energy may elect to apply a layer of Alloy 82 weld deposit over the existing DMW and adjacent material. It has been observed that when depositing Alloy 52M over Alloy 182 deposits, hot cracking can occur. The deposition of Alloy 82 can mitigate the occurrence of hot cracking in the Alloy 52M deposit. If added, the thickness of the Alloy 82 deposit will not be credited towards the structural thickness of the FSWOL. The microstructure of Alloy 52M is fully austenitic, therefore the ferrite number requirements of Code Case N-740-2 are not applicable.

(e) Weld overlay deposits will meet the following requirements:

(1) Per ASME Code Case N-740-2, the austenitic stainless steel weld overlay shall consist of at least two weld layers having as-deposited delta ferrite content of at least 7.5 FN. The first layer of weld metal with delta ferrite content of at least 7.5 FN shall constitute the first layer of the weld reinforcement that may be credited toward the required thickness. Alternatively, layers of at least 5 FN are acceptable, provided the carbon content of the deposited weld metal is determined by chemical analysis to be less than 0.02 percent.

Since an Alloy 52M weld overlay will be used, this stipulation of ASME Code Case N-740-2 will not apply.

(2) The Alloy 52M weld overlay will consist of at least two weld layers deposited using a filler material with a chromium (Cr) content of at least 28 percent. The first layer of weld metal deposited may not be credited toward the required thickness except that a first diluted layer may be credited toward the required thickness, provided the portion of the layer over the austenitic base material, austenitic filler material weld, and the associated dilution zone from an adjacent ferritic base material contain at least 20 percent Cr, and the Cr content of the deposited weld metal is determined by chemical analysis of the production weld or of a representative coupon taken from a mockup prepared in accordance with the weld procedure for the production weld.

(f) With reference to Code Case N-740-2, paragraph 1.2(f): This case is only for welding in applications predicted not to have exceeded thermal neutron (E < 0.5 eV) fluence of 1×10^{17} neutrons per cm^2 prior to welding. Duke Energy confirms the thermal neutron fluence at the N4D nozzle FSWOL location is less than the threshold.

(g) With reference to Code Case N-740-2, paragraph 1.2(g): A new weld overlay is not being installed over the top of an existing weld overlay that has been in service.

A1.3 CRACK GROWTH AND DESIGN (Correlated to N-740-2, paragraph 2)

(a) Crack Growth Calculation of Flaws in the Original Weld or Base Metal. The size of the flaw detected in the base metal will be used to define the life of each overlay. The inspection interval will not be longer than the shorter of the life of the overlay or the period specified in A1.4(c). Crack growth due to both stress corrosion and fatigue will be evaluated. Flaw characterization and evaluation will be based on the examination results or postulated flaw, as described below. The flaw is at or near the boundary of two different materials. As such, an evaluation of flaw growth in both materials will be performed.

(1) For the repair overlay, a pre-overlay examination has been performed and the initial flaw size for crack growth in the base metal will be based on the as-found flaw.

(2) Per ASME Code Case N-740-2, for postulated flaws, the axial flaw length will be 1.5 inches (i.e., 38 millimeters) or the combined width of the weld plus buttering plus any adjacent SCC susceptible material, whichever is greater. The circumferential flaw length will be assumed to be 360 degrees. The depths associated with these lengths are specified in A1.3(a)(3) and A1.3(a)(4).

(3) Per ASME Code Case N-740-2, if an ASME Section XI, Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is performed prior to application of the overlay, and no inside-surface-connected planar flaws are discovered, initial flaws originated from the inside surface of the weldment equal to 10 percent of the original wall thickness will be assumed in both the axial and circumferential directions, and the overlay shall be considered mitigative.

This stipulation of ASME Code Case N-740-2 is not applicable because ultrasonic examinations have determined the identified indication to be ID connected.

(4) Per ASME Code Case N-740-2, if an ASME Section XI, Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is not performed prior to application of the overlay, initial inside-surface-connected planar flaws equal to at least 75 percent through the original wall thickness shall be assumed, in both the axial and circumferential directions, and the overlay shall be considered a repair. For cast austenitic stainless steel (CASS) items, a 100 percent through-wall flaw shall be assumed unless the subsequent inservice inspection schedule is modified as discussed in A1.4(c)(4).

This stipulation of ASME Code Case N-740-2 is not applicable because ultrasonic examinations have been performed prior to application of an overlay. In addition, this application does not involve a cast austenitic stainless steel item.

(5) Per ASME Code Case N-740-2, there may be circumstances in which an overlay examination is performed using an ultrasonic examination procedure qualified in accordance with Appendix VIII, Supplement 11 for depths greater than the outer 25 percent of the original wall thickness (i.e., see Figure A1-2 below). For such cases, the initial flaw depths are assumed to be the detected depth found by the Appendix VIII, Supplement 11 qualified examination, plus the postulated worst-case flaw in the region not covered by the Appendix VIII ultrasonic examination.

This stipulation of ASME Code Case N-740-2 is not applicable because ultrasonic examinations have been performed; however, for the proposed crack growth evaluation, the flaw will be assumed to have 100 percent through-wall depth, for both an axial and circumferential flaw.

(6) In determining the life of each overlay, any inside-surface-connected planar flaw found by the overlay preservice inspection of A1.4(b) that exceeds the depth of (3), (4), or (5) above has been used as part of the initial flaw depth. The initial flaw depth assumed is the detected flaw depth plus the postulated worst-case flaw depth in the region of the pipe wall thickness that was not examined using an ultrasonic examination procedure meeting Appendix VIII for that region. Since the overlays will meet this condition, it is considered a repair, rather than mitigation.

(b) Structural Design and Sizing of the Overlay. The design of the weld overlays will satisfy the following, using the assumptions and flaw characterization requirements in A1.3(a). The following design analysis will be completed in accordance with IWA-4311:

(1) The axial length and end slope of the weld overlay will cover the weld and heat-affected zones on each side of the weld, as well as any stress corrosion cracking susceptible base material adjacent to the weld and provide for load redistribution from the item into the weld overlay and back into the item without violating applicable stress limits of NB-3200. Any laminar flaws in the weld overlay will be evaluated in the analysis to ensure that load redistribution complies with the above. These requirements are usually satisfied if the weld overlay full thickness length extends axially beyond the SCC susceptible material or projected flaw by at least $0.75\sqrt{Rt}$, where R is the outer radius of the item and t is the nominal wall thickness of the item at the applicable side of the overlay (i.e., R and t of the safe end transition on the safe end transition side and R and t of the pipe transition on the pipe transition side).

(2) In accordance with A1.3(b)(1), the end transition slope of the overlay will be analyzed for the design configuration.

(3) The assumed flaw in the underlying base material or weld will be based on the limiting case of A1.3(b) (3)(a) or (b), which results in the larger required overlay thickness.

(a) 100 percent through-wall circumferential flaw for the entire circumference.

(b) 100 percent through-wall flaw with length of 1.5 inches (i.e., 38 millimeters), or the combined width of the weld plus buttering plus any SCC-susceptible material, whichever is greater, in the axial direction.

(4) The overlay design thickness will be verified, using only the weld overlay thickness conforming to the deposit analysis requirements of A1.2.2(e). The combined wall thickness at the weld overlay, any postulated worst-case planar flaws under the laminar flaws in the weld overlay, and the effects of any discontinuity within a distance of $2.5\sqrt{Rt}$, from the toes of the weld overlay, including the flaw size assumptions defined in A1.3(b)(3) above, will be evaluated and shall meet the requirements of IWB-3640, IWC-3640, or IWD-3640, as applicable.

(5) The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, and changes in system flexibility and weight due to the weld overlay) will be evaluated.

A1.4 EXAMINATION (Correlated to N-740-2, paragraph 3)

In lieu of all other examination requirements, the examination requirements of this proposed method will be met for the life of the overlay. Specifically, future inservice examinations required by 10 CFR 50.55a, if more stringent than those specified herein, shall be met in lieu of the proposed inservice examinations included in this relief request. Nondestructive examination methods will be in accordance with IWA-2200, except as specified herein. Nondestructive examination personnel shall be qualified in accordance with IWA-2300. Ultrasonic examination procedures and personnel will be qualified in accordance with the modified requirements to ASME Code, Section XI, Appendix VIII, Supplement 11 as implemented through Code Case N-653-2. The examination will be performed, to the maximum extent practicable, for axial and

circumferential flaws. If 100 percent coverage of the required volume for axial flaws cannot be achieved, but essentially 100 percent coverage for circumferential flaws (i.e., 100 percent of the susceptible volume) can be achieved, the examination for axial flaws will be performed to achieve the maximum coverage practicable, with limitations noted in the examination report. The examination coverage requirements will be considered to be met.

(a) Acceptance Examination

(1) The weld overlay will have a surface finish of 250 micro-inches (μ-in), 6.3 micrometer (μm) RMS or better and contour that permits ultrasonic examination in accordance with procedures qualified in accordance with ASME Code, Section XI, Appendix VIII. The weld overlay will be inspected to verify acceptable configuration.

(2) The weld overlay and the adjacent base material for at least 1/2 inch (i.e., 13 millimeters) from each side of the overlay will be examined using the liquid penetrant method. The weld overlay will satisfy the surface examination acceptance criteria for welds of the Construction Code or NB-5300. The adjacent base material will satisfy the surface examination acceptance criteria for base material of the Construction Code or NB-2500. If ambient temperature temper bead welding is performed, the liquid penetrant examination of the completed weld overlay will be conducted no sooner than 48 hours following completion of the three tempering layers over the ferritic steel.

The 48 hours hold requirement in this stipulation does not apply. This is discussed in detail in Attachment 2.

(3) The examination volume A-B-C-D in Figure A1-1(a), shown below, will be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base material and to detect welding flaws, such as interbead lack of fusion, inclusions, or cracks. The interface C-D shown between the overlay and weld includes the bond and heat-affected zone from the overlay. If ambient temperature temper bead welding is performed, the ultrasonic examination will be conducted no sooner than 48 hours following completion of the three tempering layers over the ferritic steel. Planar flaws detected in the weld overlay acceptance examination will meet the preservice examination standards of IWB-3514. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2 defined in Figure A1-1(b) will be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end or piping material) is not susceptible to stress corrosion cracking. For susceptible material, t_1 will be used. If a flaw in the overlay crosses the boundary between the two regions, the more conservative of the two dimensions (t_1 or t_2) will be used. Laminar flaws in the weld overlay will meet the following requirements:

(a) The acceptance standards of IWB-3514 will be met, with the additional limitation that the total laminar flaw area will not exceed 10 percent of the weld surface area and that no linear dimension of the laminar flaw area shall exceed the greater of 3 inches (i.e., 76 millimeters) or 10 percent of the pipe circumference.

(b) For examination volume A-B-C-D in Figure A1-1(a), shown below, the reduction in coverage due to laminar flaws will be less than 10 percent. The uninspectable

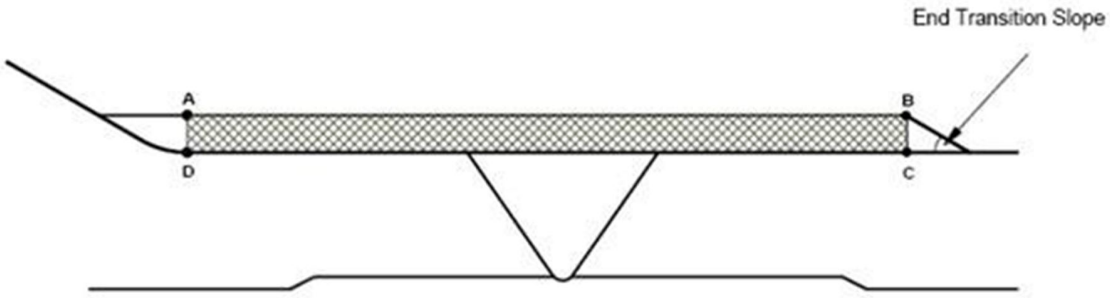
volume is the volume in the weld overlay underneath the laminar flaws for which coverage cannot be achieved with the angle beam examination method.

(c) Any uninspectable volume in the weld overlay will be assumed to contain the largest radial planar flaw that could exist within that volume. This assumed flaw will meet the preservice examination acceptance standards of IWB-3514, with nominal wall thickness as defined above the planar flaws. Alternatively, the assumed flaw will be evaluated and meet the requirements of IWB-3640, IWC-3640, and IWD-3640, as applicable. Both axial and circumferential planar flaws will be assumed.

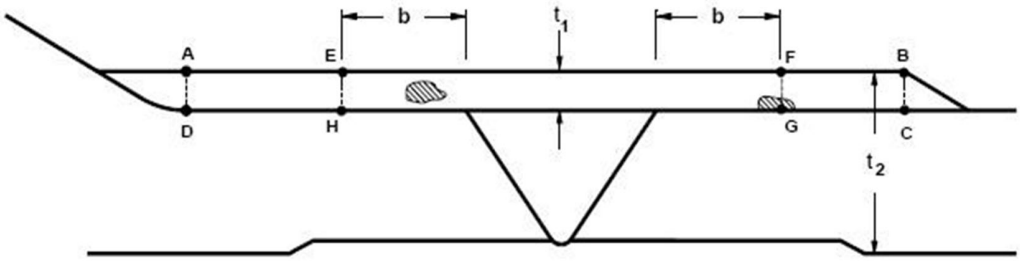
The 48 hours hold requirement in this stipulation does not apply. This is discussed in detail in Attachment 2.

(4) After completion of all welding activities, VT-3 visual examination shall be performed on all affected restraints, supports, and snubbers, to verify that design tolerances are met.

Figure A1-1 Examination Volume and Thickness Definitions



(a) Examination Volume A–B–C–D



(b) Thickness (t_1 and t_2) for Table IWB-3514-2

Notes:

1 Dimension *b* is equivalent to the nominal thickness of the nozzle or pipe being overlaid, as appropriate.
2 The nominal wall thickness is t_1 for flaws in E-F-G-H, and t_2 for flaws in A-E-H-D or F-B-C-G.
3 For flaws that span two examination volumes (e.g., illustrated at F-G), the t_1 thickness shall be used.
4 The weld includes the nozzle or safe end butter, where applied, plus any stress corrosion cracking susceptible base material in the nozzle.

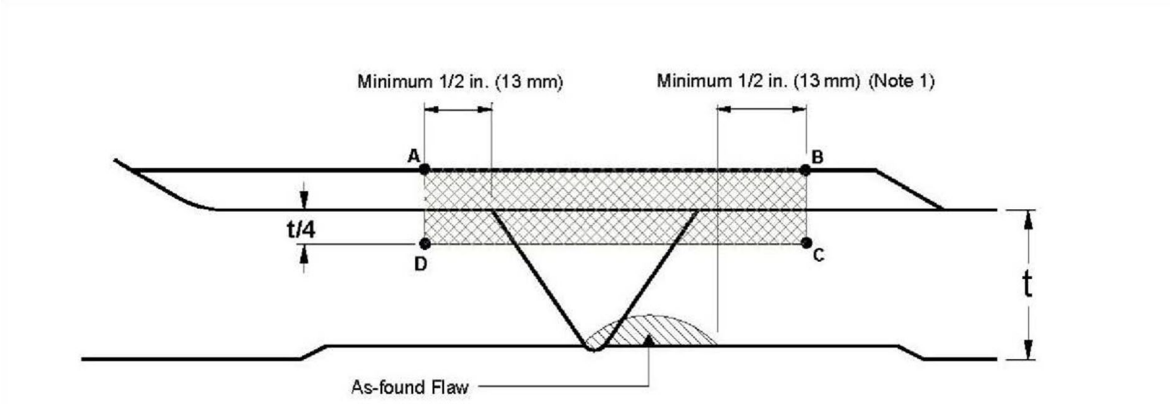
(b) Preservice Inspection

(1) The examination volume in Figure A1-2 will be ultrasonically examined. The angle beam will be directed perpendicular and parallel to the piping axis, with scanning performed in four directions, to locate and size any planar flaw that have propagated into the outer 25 percent of the base metal thickness or into the weld overlay.

(2) The preservice examination acceptance standards of IWB-3514 will be met for the weld overlay. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2, defined in Figure A1-1(b) will be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end or piping material) is not susceptible to SCC. For susceptible material, t_1 will be used. Planar flaws in the outer 25 percent of the base metal thickness will meet the design analysis requirements of A1.3(b).

(3) The flaw evaluation requirements of IWB-3640, IWC-3640, or IWD-3640 will not be applied to planar flaws, identified during preservice examination, that exceed the preservice examination acceptance standards of IWB-3514.

Figure A1-2 Preservice and Inservice Examination Volume



Examination Volume A–B–C–D

Notes:
1 The weld includes the safe end butter, where applied.
2 For axial or circumferential flaws, the axial extent of the examination volume shall extend at least 1/2 inch (i.e., 13 millimeters) beyond the as-found flaw and at least 1/2 inch (i.e., 13 millimeters) beyond the toes of the original weld, including weld end butter, where applied.

(c) Inservice Inspection

(1) Category E welds (i.e., cracked welds reinforced by weld overlay) are required by BWRVIP-75-A to be examined on the frequency of 25 percent of the population every 10 years. As such, the FSWOL applied to the N4D nozzle dissimilar metal weld will be added to the ISI Program's Category E population and be eligible for inspection at this

frequency. All weld overlays, including those not in the 25 percent sample, will be examined prior to the end of their design life as determined in A1.3(a).

(2) The weld overlay will be ultrasonically examined during the first or second refueling outage following application. Examination volumes that show no indication of crack growth or new cracking will then be placed into a population of Category E welds (i.e., cracked welds reinforced by weld overlay) to be examined on a sample basis. Twenty-five (25) percent of this population will be added to the ISI Program in accordance with BWRVIP-75-A. The 25 percent sample will consist of the same welds in the same sequence during successive intervals to the extent practical provided the 25 percent sample contains welds that experience the hottest operating temperature in the population. All weld overlays, including those not in the 25 percent sample, will be examined prior to the end of their design life as determined in A1.3(a).

(3) The weld overlay examination volume in Figure A1-2 above will be ultrasonically examined to determine if any new or existing planar flaws have propagated into the outer 25 percent of the base material thickness or into the overlay. The angle beam will be directed perpendicular and parallel to the piping axis, with scanning performed in four directions.

(4) The weld overlay will meet the inservice examination acceptance standards of IWB-3514. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2, defined in Figure A1-1(b) above will be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end, nozzle, or piping material) is not susceptible to SCC. For susceptible material, t_1 will be used. If the acceptance standards of IWB-3514 cannot be met, the weld overlay will meet the acceptance standards of IWB-3600, IWC-3600, or IWD-3600, as applicable. If a planar flaw is detected in the outer 25 percent of the base material thickness the identified flaw shall be demonstrated to satisfy all requirements, limits and assumptions defined in the design evaluation of A1.3. Any indication characterized as stress corrosion cracking in the weld overlay material will be deemed unacceptable.

(5) Weld overlay examination volumes in Figure A1-1(b) above that show no indication of planar flaw growth or new planar flaws shall be placed into a population to be examined on a sample basis as defined in the inspection plan. Twenty-five percent of this population shall be examined once during each inspection interval.

(6) If inservice examinations reveal planar flaw growth, or new planar flaws, meeting the acceptance standards of IWB-3514, IWB-3600, IWC-3600, or IWD-3600, the weld overlay examination volume will be reexamined during the first or second refueling outage following discovery of flaw growth or new flaws.

(7) For weld overlay examination volumes with unacceptable indications in accordance with A1.4(c)(5), the weld overlay and original defective weld will be removed. A repair/replacement activity will be performed in accordance with IWA-4000.

(8) No cast austenitic stainless steel components will be overlaid.

(d) Additional Examinations. If future inservice examinations reveal a defect, in accordance with A1.4(c)(4), planar flaw growth into the weld overlay design thickness, or axial flaw growth beyond the specified examination volume, additional weld overlay examination volumes, equal to the number scheduled for the current inspection period, will be examined prior to return to service. If additional defects are found in the second sample, 50 percent of the total population of weld overlay examination volumes shall be examined prior to return to service. If additional defects are found, the entire remaining population of weld overlay examination volumes shall be examined prior to return to service.

Regarding the initial sample expansion, requirements for both BWRVIP-75-A and Code Case N-578-1 were evaluated and implemented as applicable. Results of these evaluations are captured in the Duke Energy corrective action program.

A1.5 PRESSURE TESTING

A system leakage test will be performed in accordance with IWA-5000.

A1.6 DOCUMENTATION

Use of this proposed method will be documented on Form NIS-2A.

Enclosure 1, Attachment 2
Review of ASME Code Case N-740-2 against the Proposed Alternative Weld Overlay

22 Pages Follow

Attachment 2

Review of ASME Code Case N-740-2 against the
Proposed Alternative Weld Overlay

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
1. **GENERAL REQUIREMENTS**			
1.1 DEFINITION			
(a) Full Structural Weld Overlay. Deposition of weld reinforcement on the outside diameter of the piping, component, or associated weld, such that the weld reinforcement is capable of supporting the design loads, without consideration of the piping, component, or associated weld beneath the weld reinforcement. Full structural weld overlay can be either mitigative or repair weld overlay as defined in (b) and (c).	Yes		N/A
(b) Mitigative Weld Overlay. Weld overlay that is applied over material with no inside surface connected flaws found during an examination performed in accordance with 2(a)(3), prior to the weld overlay being applied.	No	Definition does not apply to proposed alternative.	N/A
(c) Repair Weld Overlay. Weld overlay that is applied over material with an inside surface connected flaw or subsurface defect, or where a pre-weld overlay examination is not performed.	Yes		N/A
(d) SCC Susceptible Materials. For this Case, the stress-corrosion-cracking (SCC) susceptible materials are UNS N06600, N06082, or W86182 in PWR environment; or UNS N06600, W86182, or austenitic stainless steels and associated welds in BWR environments.	Yes	The referenced BWR materials, UNS N06082 and W86182, are also recognized as susceptible materials in ASME Code, Section XI, 2007 Edition with 2008 addenda.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
1.2 GENERAL OVERLAY REQUIREMENTS			
(a) A full-structural weld overlay will be applied by deposition of weld reinforcement (weld overlay) on the outside surface of circumferential welds. This Case applies to austenitic nickel alloy and austenitic stainless-steel welds between the following: *(1)* P-No. 8 or P-No. 43 and P-Nos. 1, 3, 12A, 12B, or 12C[1] *(2)* P-No. 8 and P-No. 43 *(3)* Between P-Nos. 1, 3, 12A, 12B, and 12C [1] materials	Yes	The Code Case was specifically written to address the application of weld overlays over dissimilar metal welds and austenitic stainless steel welds.	N/A
(b) If a weld overlay on any of the material combinations in (a) obstructs a required examination of an adjacent P-No. 8 to P-No. 8 weld, the overlay may be extended to include overlaying the adjacent weld.	Yes	The weld overlay is being extended to include the adjacent welds to allow for examination. No P-No.8 materials are being welded.	N/A
(c) Weld overlay filler metal will be austenitic nickel alloy (28% Cr min., ERNiCrFe-7/7A) meeting the requirements of (e)(1) or (e)(2), as applicable, applied 360 deg around the circumference of the item and deposited using a Welding Procedure Specification (WPS) for groove welding, qualified in accordance with the Construction Code and Owner's Requirements identified in the Repair/Replacement Plan. **As an alternative to the post weld heat treatment (PWHT) requirements of the Construction Code and Owner's requirements, the provisions of Mandatory Appendix I may be used for ambient-temperature temper bead welding**.	Yes	The weld filler metal and procedure requirements of Code Case N-740-2 are equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, which is accepted for use by the NRC. The weld overlay will be deposited with ERNiCrFe-7A (Alloy 52M) filler metal which has excellent resistance to stress corrosion cracking as documented in EPRI Technical Report MRP-115, Section 2.2. The WPS used for depositing the	Ambient-temperature temper bead welding will be performed in accordance with Code Case N-638-11 amended as discussed below.

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
		weld overlay is qualified as a groove welding procedure to ensure that mechanical properties of the WPS are appropriately established. Where welding is performed on the ferritic nozzle material, an ambient temperature temper bead WPS will be used.	
(1) For P-No. 1 base materials, the Construction Code PWHT exemptions permitted for circumferential butt welds may be applied to exempt the weld overlay from PWHT, with the following clarifications: *(-a)* The nominal weld thickness is defined as the maximum overlay thickness applied over the ferritic base material. *(-b)* The base material thickness is defined as the maximum thickness of the ferritic material where the overlay is applied.	No	Ambient-temperature temper bead welding will be performed in accordance with Code Case N-638-11 amended as discussed below.	N/A
(2) If ambient-temperature temper bead welding is used, Mandatory Appendix I will be used.	No	Ambient-temperature temper bead welding will be performed in accordance with Code Case N-638-11 amended as discussed below.	N/A
(d) Prior to deposition of the weld overlay, the surface to be weld overlaid will be examined using the liquid penetrant method. Indications with major dimensions greater than 1/16 in. (1.5 mm) will be removed, reduced in size, or weld repaired in accordance with the following requirements:	Yes	The requirements for examination prior to deposition of the weld overlay in Code Case N-740-2 are equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, Q-2000 which has been accepted for use by the NRC.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(1) One or more layers of weld metal will be applied to seal unacceptable indications in the area to be repaired with or without excavation. The thickness of these layers will not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication prior to welding is permitted.	Yes	The requirements for examination prior to deposition of the weld overlay in N-740-2 are equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, Q-2000 which has been accepted for use by the NRC.	N/A
(2) If weld repair of indications identified in (d) is required, the area where the weld overlay is to be deposited, including any local weld repairs or initial weld overlay layer, will be examined by the liquid penetrant method. The area will contain no indications with major dimensions greater than 1/16 in. (1.5 mm) prior to application of the structural layers of the weld overlay.	Yes	The requirements for examination prior to deposition of the weld overlay in Code Case N-740-2 are equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, Q-2000 which has been accepted for use by the NRC.	N/A
(3) To reduce the potential of hot cracking when applying an austenitic nickel alloy over P-No. 8 base metal, it is permissible to apply a layer or multiple layers of austenitic stainless steel filler material over the austenitic stainless steel base metal. The thickness of these layers will not be used in meeting weld reinforcement design thickness requirements. The filler material used will meet the minimum requirements for delta ferrite.	Yes	A minimum of one layer of Alloy 82 filler material will be applied to prevent the potential of hot cracking of the Alloy 52M weld overlay material.	N/A
(e) Weld overlay deposits will meet the following requirements: *(1)* The austenitic stainless steel weld overlay will consist of at least two weld layers having as-deposited delta ferrite content of at least 7.5 FN. The first layer of weld metal with delta ferrite content of at least 7.5 FN will constitute the	No	The requirements of N-740-2(e)(1) are not applicable because Alloy 52M material will be used for the FSWOL.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
first layer of the weld reinforcement that may be credited toward the required thickness. Alternatively, layers of at least 5 FN are acceptable, provided the carbon content of the deposited weld metal is determined by chemical analysis to be less than 0.02%.			
(2) The austenitic nickel alloy weld overlay will consist of at least two weld layers deposited using a filler material with a Cr content of at least 28%. The first layer of weld metal deposited may not be credited toward the required thickness. **Alternatively, for PWR applications, a first diluted layer may be credited toward the required thickness, provided the portion of the layer over the austenitic base material, austenitic filler material weld, and the associated dilution zone from an adjacent ferritic base material contain at least 24% Cr, and the Cr content of the deposited weld metal is determined by chemical analysis of the production weld or of a representative coupon taken from a mockup prepared in accordance with the WPS for the production weld.** Alternatively, for BWR applications, a diluted layer may be credited toward the required thickness, provided the portion of the layer over the austenitic base material, austenitic filler material weld, and the associated dilution zone from an adjacent ferritic base material contain at least 20% Cr, and the Cr content of the deposited weld metal is determined by chemical analysis of the production weld or of a representative coupon taken from a mockup prepared in accordance with the WPS for the production weld.	Yes	Welding shall comply with the requirements of ASME Code Case N-638-11, “Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1”, except as follows: An alternative is proposed to the requirement of N-638-11, 4(a)(2) that requires that “When austenitic materials are used, the completed weld shall be nondestructively examined after the three tempering layers (i.e., layers 1, 2, and 3) have been in place for at least 48 hr. Examination of the welded region shall include both volumetric and surface examination methods.” N-638-11 is approved for use in Regulatory Guide 1.147. In lieu of the above requirement, nondestructive examinations may be performed after completing the weld overlay. This is consistent with requirements of ASME Code Case N-888-1 and is supported by the White	Alternative requirements for crediting the dilution layer for PWRs will not be used.

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
		Paper that was developed for the proposed change in Code Case N-888-1. The weld overlay will be deposited with ERNiCrFe-7A (Alloy 52M) filler metal which has excellent resistance to stress corrosion cracking as documented in EPRI Technical Report MRP-115, Section 2.2.	
(f) This Case is only for welding in applications predicted not to have exceeded thermal neutron (E < 0.5 eV) fluence of 1×10^{17} neutrons per cm^2 prior to welding.	Yes	Duke Energy confirms the thermal neutron fluence at the N4D nozzle FSWOL location is less than the threshold specified.	N/A
(g) A new weld overlay will not be installed over the top of an existing weld overlay that has been in service.	Yes	The proposed alternative is the first application of a weld overlay repair on these welds.	N/A
2 CRACK GROWTH AND DESIGN			
(a) Crack Growth Calculation of Flaws in the Original Weld or Base Metal. The size of the flaw detected in the base metal will be used to define the life of each overlay. The inspection interval will not be longer than the shorter of the life of the overlay or the period specified in 5.1.4(c). Crack growth due to both stress corrosion and fatigue, will be evaluated. Flaw characterization and evaluation will be based on the examination result or postulated flaw, as described below. If	Yes	These requirements are equivalent, or more stringent, than those specified in Nonmandatory Appendix Q. ASME Code, Section XI, Nonmandatory Appendix Q has been accepted for use by the NRC. These requirements will ensure that the growth of the flaw will be accounted for in the design of the overlay.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
the flaw is at or near the boundary of two different materials, evaluation of flaw growth in both materials is required.			
(1) For repair overlays, the initial flaw size for crack growth in the original weld or base metal will be based on the as-found flaw or postulated flaw, if no pre-overlay examination is performed.	Yes		N/A
(2) For postulated flaws, the axial flaw length will be 1.5 inches (i.e., 38 millimeters) or the combined width of the weld plus buttering plus any adjacent stress corrosion cracking (SCC) susceptible material, whichever is greater. The circumferential flaw length will be assumed to be 360 degrees. The depths associated with these lengths are specified in (3) and (4).	Yes	This requirement is met as a 100% through-wall 360° circumferential flaw will be assumed in the crack growth evaluation of the FSWOL.	N/A
(3) If an Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is performed prior to application of the overlay, and no inside-surface-connected planar flaws are discovered, initial flaws originated from the inside surface of the weldment equal to 10 percent of the original wall thickness will be assumed in both the axial and circumferential directions, and the overlay will be considered mitigative.	No	This requirement is not applicable because ultrasonic examinations have determined the identified flaw to be ID connected. The requirement does not apply to the proposed alternative.	N/A
(4) If an Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is not performed prior to application of the overlay, initial inside-surface-connected planar flaws equal to at least 75 percent through the original wall thickness will be assumed, in both the axial and	No	This requirement is met as a 100% through-wall 360° circumferential flaw will be assumed in the crack growth evaluation of the FSWOL.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
circumferential directions, and the overlay will be considered a repair. For cast austenitic stainless steel (CASS) items, a 100 percent through-wall flaw will be assumed unless the subsequent in-service inspection schedule is modified.			
(5) There may be circumstances in which an overlay examination is performed using an ultrasonic examination procedure qualified in accordance with Appendix VIII, Supplement 11 for depths greater than the outer 25 percent of the original wall thickness. For such cases, the initial flaw depths are assumed to be the detected depth found by the Appendix VIII, Supplement 11 qualified examination, plus the postulated worst-case flaw in the region not covered by the Appendix VIII ultrasonic examination.	No	This requirement is met as a 100% through-wall 360° circumferential flaw will be assumed in the crack growth evaluation of the FSWOL.	N/A
(6) In determining the life of each overlay, any inside-surface-connected planar flaw found by the overlay preservice inspection that exceeds the depth of (3), (4), or (5) above will be used as part of the initial flaw depth. The initial flaw depth assumed is the detected flaw depth plus the postulated worst-case flaw depth in the region of the pipe wall thickness that was not examined using an ultrasonic examination procedure meeting Appendix VIII for that region. An overlay meeting this condition will be considered a repair, rather than mitigation.	Yes	This requirement is met as a 100% through-wall 360° circumferential flaw will be assumed in the crack growth evaluation of the FSWOL.	N/A
(*b*) Structural Design and Sizing of the Overlay. The design of the weld overlay will satisfy the following, using the assumptions and flaw characterization requirements. The following design analysis will be completed in accordance with IWA-4311:	Yes	This requirement is met, as indicated below.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(1) The axial length and end slope of the weld overlay will cover the weld and heat-affected zones on each side of the weld, as well as any SCC-susceptible base material adjacent to the weld and provide for load redistribution from the item into the weld overlay and back into the item without violating applicable stress limits of NB-3200. Any laminar flaws in the weld overlay will be evaluated in the analysis to ensure that load redistribution complies with the above. These requirements are usually satisfied if the weld overlay full thickness length extends axially beyond the SCC susceptible material or projected flaw by at least 0.75 $\sqrt{}$(Rt), where R is the outer radius of the item and t is the nominal wall thickness of the item at the applicable side of the overlay (i.e., R and t of the nozzle on the nozzle side and R and t of the safe-end on the safe-end side).	Yes	These requirements are essentially the same as ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-3000(b)(1), which has been accepted for use by the NRC.	N/A
(2) Unless specifically analyzed in accordance with (1), the end transition slope of the overlay will not exceed 30 deg.	Yes	The alternative will comply with this requirement. The end transition slope of FSWOL will not exceed 45 deg., and the FSWOL will be analyzed for this transition slope.	N/A
(3) The assumed flaw in the underlying base material or weld will be based on the limiting case of (-a) and (-b) that results in the larger required overlay thickness. *(-a)* 100% through-wall circumferential flaw for the entire circumference *(-b)* 100% through-wall flaw with length of 1.5 in. (38 mm) or the combined width of the weld plus buttering plus	Yes	The limiting case of (3)(-a) will be used to determine the required thickness of the FSWOL.	N/A

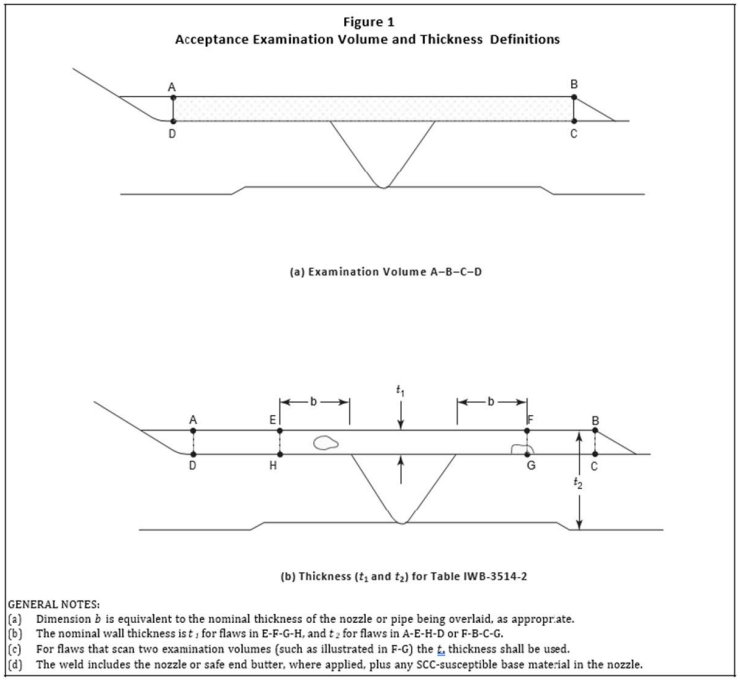
ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
any SCC-susceptible material, whichever is greater, in the axial direction			
(4) The overlay design thickness will be verified, using only the weld overlay thickness conforming to the deposit analysis requirements. The combined wall thickness at the weld overlay, any postulated worst-case planar flaws under the laminar flaws in the weld overlay, and the effects of any discontinuity within a distance of 2.5 $\sqrt{}$(Rt), from the toes of the weld overlay, including the flaw size assumptions, will be evaluated and will meet the requirements of IWB-3640, IWC-3640, or IWD-3640, as applicable.	Yes	These requirements are essentially the same as ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-3000(b)(3), which has been accepted for use by the NRC.	N/A
(5) The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, and changes in system flexibility and weight due to the weld overlay) will be evaluated. Existing flaws previously accepted by analytical evaluation will be evaluated in accordance with IWB-3640, IWC-3640, or IWD-3640, as applicable.	Yes	These requirements are more stringent than ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-3000(b)(4), which has been accepted for use by the NRC.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
3 EXAMINATION			
In lieu of all other examination requirements, the examination requirements of this Case shall be met for the life of the overlay. Nondestructive examination methods shall be in accordance with IWA-2200, except as specified herein. Nondestructive examination personnel shall be qualified in accordance with IWA-2300. **Ultrasonic examination procedures and personnel shall be qualified in accordance with Appendix VIII, Supplement 11. The examination shall be performed to the maximum extent practicable, for axial and circumferential flaws. If 100% coverage of the required volume for axial flaws cannot be achieved, but essentially 100% coverage for circumferential flaws (100% of the susceptible volume) can be achieved, the examination for axial flaws shall be per- formed to achieve the maximum coverage practicable, with limitations noted in the examination report. The ex- amination coverage requirements shall be considered to be met.** For cast stainless steel components for which no supplement is available in Appendix VIII, the weld volume shall be examined using Appendix VIII procedures to the maximum extent practicable.	Yes	The requirements for qualification of ultrasonic examination personnel in IWA-2300 of the 2007 Edition with 2008 Addenda of ASME Code, Section XI have been approved by the NRC in 10 CFR 50.55a and will be applied. ASME Code, Section XI, Code Case N-653-2, which will be applied, is approved without conditions in Table 1 of Regulatory Guide 1.147, Revision 21.	Ultrasonic examination personnel will be qualified in accordance with IWA-2300. Ultrasonic examination procedures will be qualified in accordance with the requirements of ASME Code Case N-653-2, Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds. There are no cast stainless steel components that will be overlayed by the FSWOL.

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(a) Acceptance Examination *(1)* The weld overlay will have a surface finish of 250 µin. (6.3 µm) RMS or better and contour that permits **ultrasonic examination in accordance with procedures qualified in accordance with Appendix VIII**. The weld overlay will be inspected to verify acceptable configuration.	Yes	The surface finish requirements of Code Case N-740-2 are the same as ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-4100 which has been accepted for use by the NRC. Code Case N-653-2 provides an alternative for qualification of the UT procedure, and has been reviewed and approved by the NRC, as documented in Table 1 of Regulatory Guide 1.147, Revision 21.	Ultrasonic examination procedures will be qualified in accordance with the requirements of Code Case N-653-2, Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds.
(2) The weld overlay and the adjacent base material for at least ½ in. (13 mm) from each side of the overlay will be examined using the liquid penetrant method. The weld overlay will satisfy the surface examination acceptance criteria for welds of the Construction Code or NB-5300. The adjacent base material will satisfy the surface examination acceptance criteria for base material of the Construction Code or NB-2500. **If ambient temperature temper bead welding is performed, the liquid penetrant examination of the completed weld overlay will be conducted no sooner than 48 hr following completion of the three tempering layers over the ferritic steel.**	Yes	The surface examination requirements and acceptance criteria for the weld overlay and adjacent base material are equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-4100 which has been accepted for use by the NRC. Elimination of the 48-hour hold prior to performance of NDE is discussed below.	The proposed alternative eliminates the 48-hour hold time prior to performance of NDE as discussed below.

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(3) The examination volume A-B-C-D in Figure 1(a) will be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base material and to detect welding flaws, such as interbead lack of fusion, inclusions, or cracks. The interface C-D shown between the overlay and weld includes the bond and heat-affected zone from the overlay. **If ambient temperature temper bead welding is performed, the ultrasonic examination will be conducted no sooner than 48 hr following completion of the three tempering layers over the ferritic steel.** Planar flaws detected in the weld overlay acceptance examination will meet the preservice examination standards of IWB-3514. In applying the acceptance standards to planar indications, the thickness, t_1, or t_2 defined in Figure 1(b), will be used as the nominal wall thickness in IWB-3514, provided the base material be- neath the flaw (i.e., safe end, nozzle, or piping material) is not susceptible to SCC. For susceptible material, t_1 will be used. If a flaw in the overlay crosses the boundary be- tween the two regions, the more conservative of the two dimensions (t_1 or t_2) will be used. Laminar flaws in the weld overlay will meet the following requirements:	Yes	The examination requirements in Code Case N-740-2, Figure 1(a) are identical to those specified in Section XI, Nonmandatory Appendix Q, Figure Q-4100-1, which has been accepted for use by the NRC.	The proposed alternative eliminates the 48-hour hold time prior to performance of NDE as discussed below.
(-a) The acceptance standards of IWB-3514 will be met, with the additional limitation that the total laminar flaw area will not exceed 10% of the weld surface area and that no linear dimension of the laminar flaw area will exceed the greater of 3 in. (76 mm) or 10% of the pipe circumference.	Yes		N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(-b) For examination volume A-B-C-D in Figure 1(a), the reduction in coverage due to laminar flaws will be less than 10%. The uninspectable volume is the volume in the weld overlay underneath the laminar flaws for which coverage cannot be achieved with the angle beam examination method.	Yes	Code Case N-740-2, Figure 1(a) is equivalent to ASME Code, Section XI, Nonmandatory Appendix Q, Figure Q-4100-1, which has been accepted by the NRC for defining the acceptance examination volume for weld overlay repairs. Q-4100(c)(1) of Nonmandatory Appendix Q contains the 10% limit.	N/A
(-c) Any uninspectable volume in the weld overlay will be assumed to contain the largest radial planar flaw that could exist within that volume. This assumed flaw will meet the preservice examination acceptance standards of IWB-3514, with nominal wall thickness as defined above the planar flaws. Alternatively, the assumed flaw will be evaluated and meet the requirements of IWB-3640, IWC-3640, and IWD-3640, as applicable. Both axial and circumferential planar flaws will be assumed.	Yes	The acceptance standards in Code Case N-740-2 for the weld overlay are equivalent to, or more stringent than, the rules of ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-4100 which has been accepted for use by the NRC. Q-4100(c)(2) of Nonmandatory Appendix Q contains the assumed flaw size.	N/A
(4) After completion of all welding activities, VT-3 visual examination will be performed on all affected restraints, supports, and snubbers, to verify that design tolerances are met.	Yes	A VT-3 visual examination of all affected restraints, supports, or snubbers (if applicable) will be performed to ensure that they have been returned to the design configuration following application of the weld overlay.	N/A

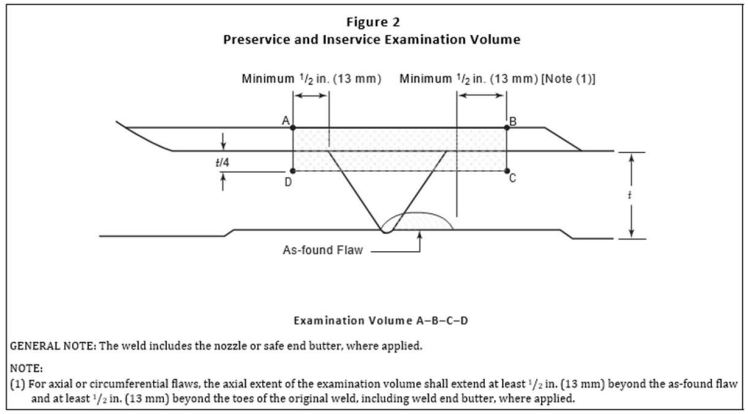
ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
N-740-2 Figure 1, Acceptance Examination Volume and Thickness Definitions  Figure 1 Acceptance Examination Volume and Thickness Definitions (a) Examination Volume A–B–C–D (b) Thickness (t_1 and t_2) for Table IWB-3514-2 GENERAL NOTES: (a) Dimension b is equivalent to the nominal thickness of the nozzle or pipe being overlaid, as appropriate. (b) The nominal wall thickness is t_1 for flaws in E-F-G-H, and t_2 for flaws in A-E-H-D or F-B-C-G. (c) For flaws that scan two examination volumes (such as illustrated in F-G) the t_s thickness shall be used. (d) The weld includes the nozzle or safe end butter, where applied, plus any SCC-susceptible base material in the nozzle.	Yes	Figure 1(a) is similar to ASME Code, Section XI, Nonmandatory Appendix Q, Figure Q-4100-1, which has been accepted by the NRC. The examination volume required by Figure 1(b) is specified to ensure that the portion of the FSWOL that covers the DM weld is capable of providing structural integrity in lieu of the underlying DM weld. Flaws in this region of the FSWOL are evaluated using the thickness t_1 when applying the preservice acceptance standards of IWB-3514.	N/A
(b) Preservice Inspection *(1)* The examination volume in Figure 2 will be ultrasonically examined. The angle beam will be directed perpendicular and parallel to the piping axis, with scanning performed in four directions, to locate and size any planar flaw that have propagated into the outer 25% of the base	Yes	The examination volume specified in Code Case N-740-2, Figure 2 is similar to that in Section XI, Nonmandatory Appendix Q, Figure Q-4300-1, which has been accepted by the NRC.	The rules for weld overlays on cast austenitic stainless steel base materials is not applicable based on the configuration. There are

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
metal thickness or into the weld overlay. **For weld overlays on cast austenitic stainless steel base materials, if a 100% through-wall flaw is used for crack growth, only planar flaws that have propagated into the weld overlay, or are in the overlay, are required to be located and sized.**			no cast stainless steel materials that will be overlayed by the FSWOL.
(2) The preservice examination acceptance standards of IWB-3514 will be met for the weld overlay. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2, defined in Figure 1(b), will be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end, nozzle, or piping material) is not susceptible to SCC. For susceptible material, t_1 will be used. Planar flaws in the outer 25% of the base metal thickness will meet the design analysis requirements of 2(b).	Yes	The preservice examination acceptance standards of Code Case N-740-2 are equivalent, or more stringent than, the requirements of ASME Code, Section XI, Nonmandatory Appendix Q, Article Q-4200, which has been accepted by the NRC.	N/A
(3) The flaw evaluation requirements of IWB-3640, IWC-3640, or IWD-3640 will not be applied to planar flaws, identified during preservice examination, that exceed the preservice examination acceptance standards of IWB-3514.	Yes	Planar flaws identified during preservice examination of the weld overlay will not be accepted by evaluation. Any flaws identified during preservice inspection of the weld overlay are required to be repaired or reduced to an acceptable size. This will confirm that there are no unacceptable planar flaws in the weld overlay volume.	N/A
(c) Inservice Inspection *(1)* The weld overlay examination will be added to the inspection plan. The weld overlay inspection interval will not be greater than the life of the overlay as determined in 2(a) above. All weld overlays will be examined prior to the end of their design life.	Yes	If the life of the overlay is less than the length of the inspection interval, this requirement will ensure that the overlay is examined prior to the end of the life of the overlay. This requirement is more	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
		stringent than that specified in Section XI, Nonmandatory Appendix Q.	
(2) The weld overlay examination volume in Figure 2 will be ultrasonically examined during the first or second refueling outage following application. **Alternatively, for mitigative weld overlays, in which pre-overlay examinations are performed in accordance with 2(a)(3), post- overlay examinations are performed in accordance with (a) and (b), and no inside-surface-connected planar flaws are discovered, the overlay may be placed immediately into the population to be examined in accordance with (5)**.	Yes	This requirement is identical to Section XI, Nonmandatory Appendix Q, Q-4300(a), which has been approved for use by the NRC. These examinations will confirm whether there has been any growth of the flaw in the overlaid weld. The FSWOL will be ultrasonically examined during the first or second refueling outage following application.	The FSWOL is not considered a mitigative weld overlay
(3) The weld overlay examination volume in Figure 2 will be ultrasonically examined to determine if any new or existing planar flaws have propagated into the outer 25% of the base material thickness or into the overlay. The angle beam will be directed perpendicular and parallel to the piping axis, with scanning performed in four directions.	Yes	The ultrasonic examination will interrogate the outer 25 percent of the base material and DM weld within the volume in Figure 2 to monitor the growth of the flaw, or growth of any new flaws in the DM weld and adjacent base metal. Figure 2 of the alternative is similar to Section XI, Nonmandatory Appendix Q, Figure Q-4300-1 and Code Case N-740-2, Figure 2. ASME Code, Section XI, Nonmandatory Appendix Q, Figure Q-4300-1, for FSWOL examination has been accepted by the NRC.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(4) The weld overlay will meet the inservice examination acceptance standards of IWB-3514. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2, defined in Figure 1, sketch (b), will be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end, nozzle, or piping material) is not susceptible to SCC. For susceptible material, t_1 will be used. If the acceptance standards of IWB-3514 cannot be met, the weld overlay will meet the acceptance standards of IWB-3600, IWC-3600, or IWD-3600, as applicable. If a planar flaw is detected in the outer 25% of the base material thickness will meet the design analysis requirements of 2. Any indication characterized as stress corrosion cracking in the weld overlay material is unacceptable.	Yes	Figure 2 of the alternative is similar to Section XI, Nonmandatory Appendix Q, Figure Q-4300-1 and Code Case N-740-2, Figure 2. ASME Code, Section XI, Nonmandatory Appendix Q, Figure Q-4300-1, for FSWOL examination has been accepted by the NRC.	N/A
(5) Weld overlay examination volumes in Figure 2 that show no indication of planar flaw growth or new planar flaws will be placed into a population to be examined on a sample basis, except as required by (1). Twenty-five percent of this population will be examined once during each inspection interval.	Yes	This alternative requirement is identical to that in Code Case N-740-2 and Nonmandatory Appendix Q. ASME Code, Section XI, Nonmandatory Appendix Q, has been accepted by the NRC.	N/A
(6) If inservice examinations reveal planar flaw growth, or new planar flaws, meeting the acceptance standards of IWB-3514, IWB-3600, IWC-3600, or IWB-3600, the weld overlay examination volume will be reexamined during the first or second refueling outage following discovery of the growth or new flaws.	Yes	This alternative requirement is identical to that in Code Case N-740-2 and is essentially the same as that required by Nonmandatory Appendix Q. ASME Code, Section XI, Nonmandatory Appendix Q, has been accepted by the NRC.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
(7) For weld overlay examination volumes with un-acceptable indications in accordance with (4), the weld overlay, and original defective weld will be removed. A repair/replacement activity will be performed in accordance with IWA-4000.	Yes	The alternative will comply with this requirement.	N/A
(8) If preservice and inservice examinations in accordance with ASME Section XI, Appendix VIII, Supplement 11 cannot be performed for the entire weld overlay examination volume in Figure 2 because of cast austenitic stainless steel items, and a 100% initial flaw assumption is not used in the crack growth evaluation of 2(a), a 75% through- wall depth may be assumed in the crack growth calculation, provided that the required examination volume is examined at a higher frequency than the requirements in (c). The subject weld will be ultrasonically examined during the first or second refueling outage following the weld overlay installation. If ultrasonic examination is performed prior to weld overlay installation and after installation without detecting any planar flaws in the original weld or the weld overlay, then the ultrasonic examination during the first or second refueling outage is not required. After the first inservice examination, the required examination volume will be ultrasonically examined every 10 years from the date of the installation until such time when ultrasonic examination is qualified to examine the cast austenitic stainless-steel portion of the required inspection volume in accordance with the performance demonstration requirements of ASME Code, Section XI, Appendix VIII. The inspection of the overlaid weld will not be credited to satisfy the requirement of the 25% inspection sample every ten years of overlaid welds without cast stainless steel materials. After the required examination volume is examined by	No	This requirement does not apply to the proposed alternative because there are no cast austenitic stainless steel materials being overlayed.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
qualified ultrasonic examination for the cast austenitic stainless-steel material and no planar flaws are detected, the weld may be placed in the 25% inspection sample population in accordance with (5).			
N-740-2 Figure 2, Preservice and Inservice Examination Volume  Figure 2 Preservice and Inservice Examination Volume Minimum $^1/_2$ in. (13 mm) Minimum $^1/_2$ in. (13 mm) [Note (1)] A B t/4 D C t As-found Flaw Examination Volume A–B–C–D GENERAL NOTE: The weld includes the nozzle or safe end butter, where applied. NOTE: (1) For axial or circumferential flaws, the axial extent of the examination volume shall extend at least $^1/_2$ in. (13 mm) beyond the as-found flaw and at least $^1/_2$ in. (13 mm) beyond the toes of the original weld, including weld end butter, where applied.	Yes	This figure is identical to that in ASME Code, Section XI, Nonmandatory Appendix Q, Figure Q-4300-1. Nonmandatory Appendix Q. ASME Code, Section XI, Nonmandatory Appendix Q, has been accepted by the NRC.	N/A
(d) Additional Examinations. If inservice examinations reveal a defect, in accordance with (c)(4) above, planar flaw growth into the weld overlay design thickness, or axial flaw growth beyond the specified examination volume, additional weld overlay examination volumes, equal to the number scheduled for the current inspection period, will be examined prior to return to service. If additional defects are found in the second sample, 50% of the total population of weld overlay examination volumes will be examined prior to return to service. If additional defects are found, the entire remaining population of weld overlay examination volumes will be	Yes	This requirement is essentially the same as that in Section XI, Nonmandatory Appendix Q, Q-4310. Nonmandatory Appendix Q. ASME Code, Section XI, Nonmandatory Appendix Q, has been accepted by the NRC.	N/A

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
examined prior to return to service.			
4 PRESSURE TESTING A system leakage test will be performed in accordance with IWA-5000.	Yes	IWA-5214 requires a preservice system pressure test following repair/replacement activities in accordance with IWA-4540. IWA-4540(b)(3) exempts welding or brazing that does not penetrate through the pressure boundary from a pressure test and VT-2 examination. The FWSOL does not penetrate through the full thickness of the pressure boundary and is therefore exempt from the pressure testing requirements of IWA-4540. However, the FSWOL is within the boundary of IWB-5222(a) and will be subject to pressurization and a VT-2 examination as part of the Class 1 system leakage test prior to return to service.	N/A
5 DOCUMENTATION Use of this Case will be documented on Form NIS-2.	Yes	Documentation of the use of this ASME Code Case in the post outage summary report is an administrative requirement.	N/A
MANDATORY APPENDIX I, AMBIENT-TEMPERATURE TEMPER BEAD WELDING	No	Code Case N-638-11, Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique is listed in Table 1 of Regulatory Guide 1.147 Revision 21.	The proposed alternative will utilize the rules of Code Case N-638-11 to apply the weld overlay with the exception of the 48-hour hold prior to completion of NDE. In

ASME Code Case N-740-2 Requirement	Included in Proposed Alternative	Justification	Exceptions to N-740-2 (highlighted in bold)
		Removal of the 48-hour hold is consistent with the requirements of ASME Code Case N-888-1 and is supported by the white paper that was developed for the proposed change. Although this ASME Code Case is not approved in Regulatory Guide 1.147, it has been approved by the ASME Section XI Standards Committee. The white paper has been published in the 2023 PVP Conference Proceedings in July 2023, PVP2023-107489. *The supporting White Paper was previously submitted during the Nine Mile Point, Unit 1 Relief Request ML23089A230. The white paper provides a technical basis for eliminating this requirement.*	lieu of the 48-hour hold NDE may be performed after completion of the weld overlay.

Enclosure 2
List of Regulatory Commitments

1 Page Follows

List of Regulatory Commitments

The following table identifies the actions in this document to which the Brunswick Steam Electric Plant (BSEP) has committed. Statements in this submittal, with the exception of those in the table below, are provided for information purposes and are not considered commitments.

Please direct questions regarding these commitments to Ryan Treadway, Director - Nuclear Fleet Licensing, at (980) 373-5873.

COMMITMENT DESCRIPTION	ONE-TIME ACTION	CONTINUING COMPLIANCE	SCHEDULED COMPLETION DATE
The following information regarding the N4D nozzle will be submitted to the NRC: 1. A listing of indications detected in the full structural weld overlay material. 2. A description of any repairs to the full structural weld overlay material and the reason for the repair. 3. The disposition of all indications using the acceptance criteria of ASME Code, Section XI, IWB-3514. 4. A summary of the residual stress, crack growth analysis and ASME code, Section XI evaluation.	☒		Within 120 days following the end of refueling outage B1R26