WOLF CREEK
NUCLEAR OPERATING CORPORATION

Terry J. Garrett
Vice President Engineering

May 19, 2006

ET 06-0021

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

Subject: Docket No. 50-482: 10 CFR 50.55a Request I3R-05, Installation and Examination of Full Structural Weld Overlays for Repairing/Mitigating Pressurizer Nozzle-to-Safe End Dissimilar Metal Welds and Adjacent Safe End-to-Piping Stainless Steel Welds

Gentlemen:

Pursuant to 10 CFR 50.55a(a)(3)(i), Wolf Creek Nuclear Operating Corporation (WCNOC) hereby requests Nuclear Regulatory Commission (NRC) approval of 10 CFR 50.55a Request I3R-05 for the Third Ten-Year Interval of WCNOC's Inservice Inspection (ISI) and Repair/Replacement Programs.

Enclosed is 10 CFR 50.55a Request Number I3R-05, which requests alternatives to the requirements of ASME Section XI, IWA-4420 (and its referenced original Construction Code for the Pressurizer and attached piping), IWA-4430, IWA-4520(a), IWA-4530, IWA-4600, and Table IWB-2500-1 (Examination Categories B-F and B-J), for the installation and examination of full structural weld overlays for repairing/mitigating Pressurizer nozzle-to-safe end dissimilar metal (DM) and safe end-to-piping stainless steel (SS) butt welds. These proposed alternatives provide an acceptable level of quality and safety as required by 10 CFR 50.55a(a)(3)(i).

The NRC has approved requests similar to this request for other utilities as identified in Section 7.0, "Precedents," of the enclosure.

WCNOC requests approval of 10 CFR 50.55a Request I3R-05 by September 15, 2006 to facilitate installation of the weld overlays in Wolf Creek Generating Station (WCGS) Refueling Outage 15.

A047

There are no commitments contained within this letter. If you have any questions, please contact me at (620) 364-4084 or Mr. Kevin Moles at (620) 364-4126.

Sincerely,

Gary J. Pendergrass

for Terry J. Garrett

TJG/rlt

Enclosure: 10 CFR 50.55a Request Number I3R-05

cc: J. N. Donohew (NRC), w/e
W. B. Jones (NRC), w/e
B. S. Mallett (NRC), w/e
Senior Resident Inspector (NRC), w/e

Enclosure to ET 06-0021

Wolf Creek Nuclear Operating Corporation
10 CFR 50.55a Request Number I3R-05

10 CFR 50.55a Request Number I3R-05

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1.0 ASME CODE COMPONENTS AFFECTED

Description:	Nozzle-to-safe end dissimilar metal (DM) Alloy 82/182 butt welds and safe end-to-piping stainless steel (SS) butt welds on the safety, relief, spray, and surge line connections to the Pressurizer
Code Class:	Class 1
Examination Categories:	R-A (risk informed designation for B-F and B-J categories)
Weld Numbers:	TBB03-2-W (4" spray nozzle-to-safe end weld) BB-04-F001 (4" spray safe end-to-piping weld) TBB03-3-A-W (6" safety "A" nozzle-to-safe end weld) BB-02-F001A (6" safety "A" safe end-to-piping weld) TBB03-3-B-W (6" safety "B" nozzle-to-safe end weld) BB-02-F005A (6" safety "B" safe end-to-piping weld) TBB03-3-C-W (6" safety "C" nozzle-to-safe end weld) BB-02-F006A (6" safety "C" safe end-to-piping weld) TBB03-4-W (6" relief nozzle-to-safe end weld) BB-02-F008 (6" relief safe end-to-piping weld) TBB03-1-W (14" surge nozzle-to-safe end weld) BB-01-F004B (14" surge safe end-to-piping weld)

2.0 APPLICABLE CODE EDITION AND ADDENDA

The following editions and addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections III and XI, are used at Wolf Creek Generating Station (WCGS):

- ASME Section XI, 1998 Edition through the 2000 Addenda for the 3rd interval Inservice Inspection (ISI) and Repair/Replacement Programs
- ASME Section III, 1974 Edition through Summer 1974 Addenda [Original Code of Construction for Pressurizer]
- ASME Section III, 1974 Edition through Winter 1974 Addenda [Original Code of Construction for top of Pressurizer piping]
- ASME Section III, 1974 Edition through Summer 1975 Addenda [Original Code of Construction for bottom of Pressurizer piping]

3.0 APPLICABLE CODE REQUIREMENTS

IWA-4420 and IWA-4520(a) of ASME Section XI require repair/replacement activities to be performed and examined in accordance with the Owner's Requirements and the original Construction Code of the component or system. IWA-4430 and IWA-4600 provide for alternative welding methods when the requirements of IWA-4420 cannot be met. IWA-4530 requires a preservice examination to be performed in accordance with IWB-2200. Table IWB-2500-1 Categories B-F and B-J prescribe inservice examination requirements for Class 1 butt welds. Section XI Appendix VIII Supplement 11 specifies the performance demonstration requirements for ultrasonic examination of weld overlays.

4.0 REASON FOR REQUEST

Primary Water Stress Corrosion Cracking (PWSCC) of Alloy 600/82/182 components exposed to pressurized water reactor (PWR) primary coolant has become a growing concern in the nuclear industry over the past decade. In particular, base metal and weld metal components exposed to elevated temperatures, like the pressurizer, are believed to pose a heightened propensity to PWSCC.

Wolf Creek Nuclear Operating Corporation (WCNOC) has concluded that the application of either a full structural repair weld overlay or a preemptive full structural weld overlay to the Pressurizer nozzle DM welds is the most appropriate course of action to ensure reactor coolant system (RCS) pressure boundary integrity and improve future inspectability. The weld overlay of the DM nozzle-to-safe end weld will preclude future examination of the SS safe end-to-pipe weld due to the close proximity of the two welds. Therefore, each weld overlay will extend from the low alloy steel nozzle across both butt welds to the stainless steel pipe. WCNOC will perform examinations of the nozzle-to-safe end DM butt welds and the adjacent safe end-to-piping SS butt welds on the safety, relief, spray, and surge line connections to the Wolf Creek Pressurizer during the upcoming Refueling Outage 15 in October 2006 using Performance Demonstration Initiative (PDI) qualified procedures. If greater than or equal to 90% coverage of the original DM and SS welds is achieved with PDI qualified procedures and no PWSCC flaws or service related flaws are identified, a preemptive full structural weld overlay is proposed to be installed to mitigate the potential for future degradation. If greater than or equal to 90% coverage can not be obtained, or if PWSCC or service related flaws are identified, a full structural repair weld overlay is proposed to be installed to repair the degradation or the possibility of undetected degradation.

Structural weld overlays have been used for over 20 years for repair and mitigation of intergranular stress corrosion cracking in boiling water reactors and more recently for repair of PWSCC in pressurized water reactors. In some cases, full structural weld overlays have been used to reestablish structural integrity of DM butt welds containing through wall leaking flaws. Full structural weld overlays arrest existing flaws from propagating by favorable residual compressive stresses in the inner portions of the original susceptible welds, provide a PWSCC resistant material, and provide structural reinforcement that meets ASME Code Section XI margins even with existing cracks remaining in the original susceptible welds.

As discussed in this Request, there is no approved comprehensive criterion for WCNOC to apply a full structural nickel alloy weld overlay to a DM weld that is constructed of Alloy 82/182 weld material and is believed to be susceptible to or contains PWSCC degradation. Although the ASME Code, Section XI, 1998 Edition through 2000 Addenda Article IWA-4000 is used for the WCNOC Repair/Replacement Program, it does not have the needed requirements for this type of weld overlay repair/mitigation. The latest Nuclear Regulatory Commission (NRC) approved ASME Code also does not have the needed requirements for this type of weld overlay. ASME is in the process of preparing and approving a Code Case to provide the comprehensive provisions for this type of weld overlay but the Case has not yet been approved by ASME.

Section 3.0 of this Request identifies Code requirements that cannot be met or are not applicable when applying full structural nickel alloy weld overlays as described in this Request. Therefore, in lieu of IWA-4420 (and its referenced original Construction Code for the Pressurizer and attached piping), IWA-4430, IWA-4520(a), IWA-4530, IWA-4600, and the inservice examination requirements of Table IWB-2500-1, alternative requirements are requested for the installation and examination of full structural weld overlays for repairing/mitigating the DM welds and SS welds identified in section 1.0 of this Request. These alternative requirements use methodologies and requirements similar to those in ASME Code Cases N-504-3 and N-638-1. However, as described in section 5.0 of this Request, Cases N-504-3 and N-638-1 cannot be used without modifications.

The WCNOC risk-informed ISI Program prescribes inservice examination requirements for Class 1 butt welds that are used in lieu of the requirements of ASME Section XI Table IWB-2500-1. However, with this Request, the weld overlays installed on the welds identified in section 1.0 of this Request will be included in the WCNOC ISI Program Plan in place of the original DM and SS welds and will be examined as described in section 5.0 of this Request. The original DM and SS welds will be removed from the WCNOC risk-informed ISI Program.

Pursuant to 10CFR50.55a(a)(3)(i), alternatives are requested on the basis that the proposed alternatives will provide an acceptable level of quality and safety.

5.0 PROPOSED ALTERNATIVE AND BASIS FOR USE

A) Proposed Alternative For Application of Weld Overlays Using Modified Code Case N-504-3

A full structural repair weld overlay or a preemptive full structural weld overlay is proposed for each Pressurizer nozzle-to-safe end Alloy 82/182 butt weld. The weld overlay of the DM nozzle-to-safe end weld will preclude future examination of the SS safe end-to-pipe weld due to the close proximity of the two welds. Therefore, each weld overlay will extend from the low alloy steel nozzle across both butt welds to the stainless steel pipe. ASME Code Case N-504-3, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping," allows a flaw to be reduced to an acceptable size through the deposition of weld reinforcement on the outside surface of the pipe without flaw removal. In this Request, an alternate application for nickel-based and low alloy steel materials is proposed due to the materials and configuration of the subject welds, and the lack of an approved Code Case for this application. As described in the following paragraphs, Code Case N-504-3 and Nonmandatory Appendix Q will be used along with the modifications detailed in Table 2.

Code Case N-504-3 is not listed in Regulatory Guide 1.147, Revision 14. However, Code Case N-504-2 is approved for use for austenitic stainless steel material in Regulatory Guide 1.147, Revision 14, with a condition that the provisions of Nonmandatory Appendix Q of the 2005 Addenda of ASME Section XI also must be met. According to the ASME Section XI Code Case Applicability Index, Code Case N-504-2 applicability does not apply to the ASME Section XI 2000 Addenda used for the WCNOC Repair/Replacement Program; therefore, Code Case N-504-3 is included in this request.

According to the ASME action that approved Case N-504-3, the following changes were made to Case N-504-2. N-504-2 was revised to correct references to IWA-4410 and Tables IWB-3641-5 and IWB-3641-6. The 1997 Addenda moved the defect removal rules from IWA-4410 to IWA-4420. The 1996 Addenda deleted Tables IWB-3641-5 and -6, and included the flaw evaluation requirements for submerged arc welding (SAW) and shielded metal arc welding (SMAW) weld metal in Tables IWB-3641-1 and -2. The 2002 Addenda then deleted these tables and incorporated their provisions into IWB-3640. In addition, the 1995 Addenda added a reference in IWA-4810(a) [which later became IWA-4520(a)] to Construction Code examination requirements that were never meant to be applied to these overlays. These revisions are all intended to make the Case usable with all Editions and Addenda of Section XI from the Summer 1978 Addenda through the 2004 Edition. The revision also clarifies which acceptance criteria of IWB-3514 apply to different kinds of flaws. Additionally, (f)(1) was revised to address the case where the flawed weld may have one axial flaw exactly 1.5 in. long, and exactly five axial flaws of any length. The laminar flaw acceptance criteria in paragraph (i) were revised to address an uninspectable volume below laminar flaws and the reduction in examination volume coverage due to laminar flaws. The submerged arc welding method was also prohibited for use on weld overlays. These changes incorporated into N-504-3 are consistent with Nonmandatory Appendix Q, which the NRC has required to be used with Case N-504-2. Therefore, the use of Case N-504-3 and Nonmandatory Appendix Q is consistent with provisions already approved by the NRC.

Table 1 identifies the materials of construction for the pressurizer nozzle-to-pipe assemblies within the scope of this Request. Figure 1 shows the generic configuration of the nozzle-to-pipe assemblies but does not reflect the actual external or internal surface profiles.

Figure 1: Generic Pressurizer Nozzle Configuration

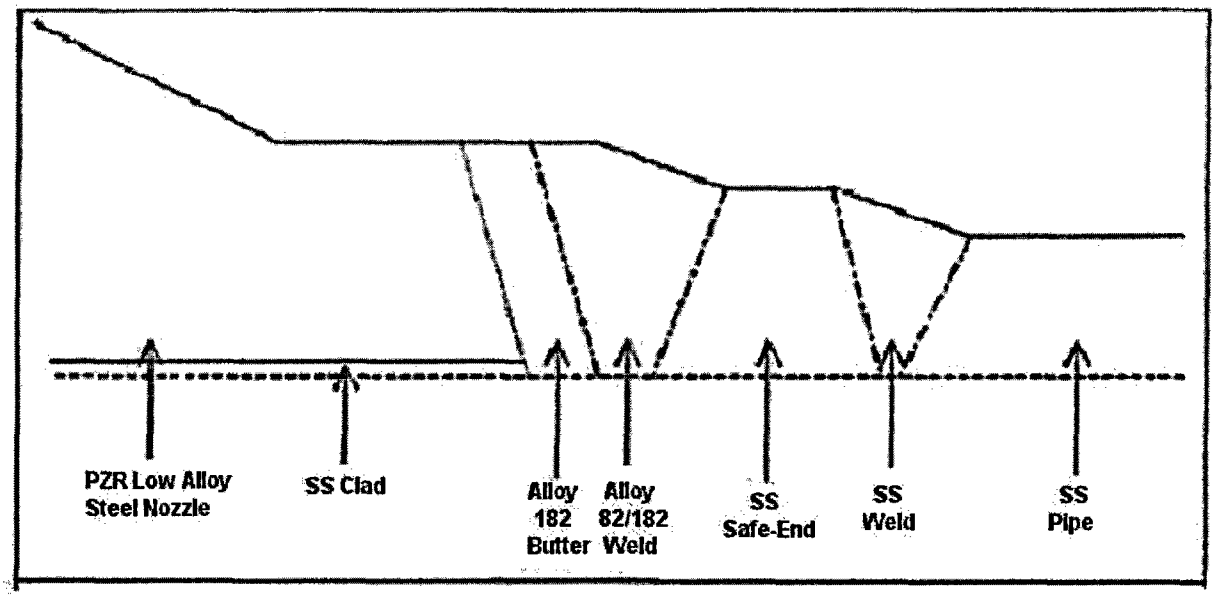

Table 1: WCGS Pressurizer Nozzle Material Identification

Nozzle Type	NPS	N-SE Weld ID[1] SE-P Weld ID[1]	Material Identification				
			Nozzle	N-SE Weld	Safe End	SE-P Weld	Pipe
Spray	4"	TBB03-2-W BB-04-F001	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308)	Schedule 160, SA-312, Type 304S
Safety "A"	6"	TBB03-3-A-W BB-02-F001A	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308 and ER308L for root inserts)	Schedule 160, SA-312, Type 304S
Safety "B"	6"	TBB03-3-B-W BB-02-F005A	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308 and ER308L for root inserts)	Schedule 160, SA-312, Type 304S
Safety "C"	6"	TBB03-3-C-W BB-02-F006A	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308 and ER308L for root inserts)	Schedule 160, SA-312, Type 304S
Relief	6"	TBB03-4-W BB-02-F008	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308 and ER308L for root inserts)	Schedule 160, SA-312, Type 304S
Surge	14"	TBB03-1-W BB-01-F004B	SA-508, Class 2a	DM Shop Weld (Alloy 82/182)	SA-182, Grade F-316L	SS Field Weld (ER308/E308 with ER316 for repair)	Schedule 160, SA-376, Type 316S

Table 1 Footnote 1: N-SE refers to Nozzle-to-Safe End and SE-P refers to Safe End-to-Piping.

Each weld overlay will be designed consistent with the requirements of ASME Code Case N-504-3 and Nonmandatory Appendix Q, with the modifications noted in Table 2. The design of each overlay will assume that a 360° circumferential through-wall flaw is present in the original Alloy 82/182 weld and in the original SS weld. Each weld overlay will extend around the full circumference of the nozzle-to-piping weld locations as required by Code Case N-504-3. The specific thickness and length will be calculated according to the guidance provided in Code Case N-504-3 and Nonmandatory Appendix Q.

The determination of the life of the overlay will be based on the size of any indications in the region of the overlay. The existence of (or lack of) any flaws will be known or assumed due to the planned performance of qualified ultrasonic examinations prior to application of the overlays. As such, either the size and location of flaws will be known or assumptions are required to be made as to the size and location of flaws that may be present in the original dissimilar metal welds or original stainless steel welds. Fatigue crack growth evaluations will be performed for the dissimilar metal butt weld and the SS butt weld to demonstrate that the weld overlay thickness is sized adequately to satisfy the requirements in the flaw evaluation procedures of IWB-3640. The initial flaw size assumed in the fatigue crack growth calculations will be based on the pre-weld overlay UT examinations, and will be checked with the post-weld overlay UT examinations. If no service-related flaw is found, a flaw will be assumed with depth equal to the UT sensitivity. If the crack growth analysis shows that a flaw will not grow to the allowable flaw size for the normal ASME Code, Section XI inspection interval, then the existing Code interval will be used for subsequent in-service inspections. If the crack growth analysis shows that the assumed crack will grow to the allowable flaw size, then the in-service inspection interval will be established based on this time. The allowable flaw size will be that flaw size that meets the analytical requirements of Section XI, IWB-3640.

Preservice inspections and inservice inspections will be performed in accordance with Code Case N-504-3, Nonmandatory Appendix Q, Subarticles Q-4200 and Q-4300, and ASME Section XI, 1998 Edition through the 2000 Addenda, Appendix VIII, Supplement 11, with modifications noted in Tables 2 and 4. Details regarding the in-process, preservice, and inservice examinations that will be applied to the proposed weld overlays are shown in Table 5. These examinations meet all of the applicable Code and Code Case requirements as modified by this Request.

Section 3.0 of this Request identifies Code requirements that cannot be met or are not applicable when applying full structural nickel alloy weld overlays. The following explanation provides the basis for concluding that IWA-4420 and IWA-4520(a) are not applicable when using Case N-504-3 and Nonmandatory Appendix Q, as well as the basis for Case N-504-3 and Nonmandatory Appendix Q alternatives to IWA-4530, IWB-2200, and Table IWB-2500-1 categories B-F and B-J. As noted in the Reply paragraph of Code Case N-504-3, the provisions of N-504-3 are to be used in lieu of IWA-4420 and IWA-4520(a), which are the applicable Construction Code and examination paragraph references in the 2000 Addenda used for WCNOC's Repair/Replacement Program. Therefore, IWA-4420 and IWA-4520(a) are clearly not applicable to these weld overlay applications. The scope of Nonmandatory Appendix Q also states that the Appendix provides alternatives to the preservice examination requirements of IWA-4530 because the preservice examination requirements referenced by IWA-4530 do not have configurations applicable to weld overlays. Appendix Q provides specific preservice and inservice examination provisions applicable to weld overlay applications. Therefore, the Appendix Q specific provisions for weld overlays replace the preservice and inservice examination requirements of IWB-2200 and Tables IWB-2500-1 Categories B-F and B-J.

B) Proposed Alternative For Application of Ambient Temperature Machine Gas Tungsten Arc Welding (GTAW) Temper Bead Technique Using Modified Code Case N-638-1

Application of the structural weld overlays will require welding to the low alloy steel nozzle material. The ASME Section XI requirement to use ASME Section III for some repair/replacement requirements does not permit welding to the low alloy steel nozzle without pre-heat or post-weld heat treatment. In lieu of these ASME Section XI requirements, the requirements of ASME Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique", will be met with the modifications detailed in Table 3. Code Case N-638-1 is conditionally approved for use in Regulatory Guide 1.147, Revision 14. The condition relates to the ultrasonic examination required by Case N-638-1. However, the modifications noted in Table 3 will perform the ultrasonic examinations of Code Case N-504-3 applicable to weld overlays, as noted in Tables 2 and 5, in lieu of the Code Case N-638-1 ultrasonic examination applicable to base metal/weld metal excavations and rewelding. Therefore, as discussed in Table 3, the NRC condition on use of N-638-1 is not applicable to this Request and will not be applied.

The Code Case N-638-1 ambient temperature temper bead welding technique permits application of the structural weld overlay without the need for elevated preheat or post-weld heat treatment required by ASME Section III. The technique has been qualified and will be performed using the methodology described in ASME Code Case N-638-1. Welding will commence when the base materials exhibit a minimum preheat of 50 degrees Fahrenheit. The maximum interpass temperature during weld overlay installation will be 350 degrees Fahrenheit. During the welding, heat input will be precisely controlled to conform to the welding procedure specification.

Section 3.0 of this Request identifies Code requirements that cannot be met or are not applicable when applying full structural nickel alloy weld overlays. The following explanation provides the basis for concluding that IWA-4430 and IWA-4600 are not applicable when using Case N-638-1. IWA-4430 allows the use of IWA-4600 when the Construction Code requirements of IWA-4420 cannot be met. However, IWA-4600 provides specific alternative welding methods that may be used and general requirements that apply to those specific alternative welding methods. Ambient temperature machine GTAW temper bead welding allowed by Case N-638-1 is not an alternative welding method identified in IWA-4600. Code Case N-638-1 provides the applicable requirements that apply to the use of this specific alternative welding method and IWA-4600 does not apply.

C) Proposed Alternatives to ASME Section XI, Appendix VIII, Supplement 11

ASME Section XI, 1998 Edition through 2000 Addenda, Appendix VIII, along with Appendix VIII Supplement 11, addresses the requirements for performance demonstration for ultrasonic examination procedures, equipment, and personnel used to detect and size flaws in full structural overlays of wrought austenitic piping welds. Appendix VIII Supplement 11 qualification requirements are modified by the proposed alternatives in the PDI program as indicated in Table 4 because the industry cannot meet the requirements of Appendix VIII, Supplement 11. Therefore, the PDI alternatives to Section XI, Appendix VIII, Supplement 11 as described in Table 4 will be used for qualification of ultrasonic examinations used to detect and size flaws in the full structural weld overlays of this Request.

6.0 DURATION OF THE PROPOSED ALTERNATIVE

The alternatives in this Request are requested for the design life of the weld overlays, as determined by the required evaluation in Paragraph (g) of Code Case N-504-3 and the corresponding requirements in Nonmandatory Appendix Q and as verified by periodic inservice examinations as described herein.

7.0 PRECEDENTS

Similar 50.55a Requests have been approved by the NRC as identified in the following letters:

1. Letter from Richard J. Laufer, NRC, to Christopher M. Crane, AmerGen, "Three Mile Island Nuclear Station, Unit 1 (TMI-1) Request for Relief from Flaw Removal, Heat Treatment, and Nondestructive Examination Requirements for the Third 10-year Inservice Inspection (ISI) Interval (TAC.No. MC1201)," Accession Number ML041670510, dated July 21, 2004.
2. Letter from Richard J. Laufer, NRC, to Bryce L. Shriver, PPL Susquehanna, "Susquehanna Steam Electric Station, Unit 1 - Relief from American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), Section XI, Appendix VIII, Supplement 11, Requirements and Code Cases N-504-2 and N-638 Requirements (TAC Nos. MC2450, MC2451 and MC2594)," Accession Number ML051220568, dated June 22, 2005.
3. Letter from L. Raghavan, NRC, to Mano K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Unit 1 - Alternative to Repair Requirements of Section XI of the American Society of Mechanical Engineers Code (TAC No. MC06751)," Accession Number ML051720006, dated June 27, 2005.
4. Letter from Richard J. Laufer, NRC, to George Vanderheyden, Calvert Cliffs, "Calvert Cliffs Nuclear Power Plant, Unit No. 2 - Relief Request for Use Weld Overlay and Associated Alternative Inspection Techniques (TAC Nos. MC6219 and MC6220)," Accession Number ML051930316, dated July 20, 2005.
5. Letter from Darrell J. Roberts, NRC, to David A. Christian, Dominion Nuclear Connecticut, Inc., "Millstone Power Station, Unit No. 3- Issuance of Relief from Code Requirements (TAC No. MC8609)," Accession Number ML053260012, dated January 20, 2006.

Table 2: Modifications to Code Case N-504-3 and Corresponding Nonmandatory Appendix Q Requirements

Code Case N-504-3 and Nonmandatory Appendix Q	Modification and Basis
Reply: It is the opinion of the Committee that, in lieu of the requirements of...IWA-4420 in the 1995 Edition with the 1997 Addenda and later Editions and Addenda...and in IWA-4520(a) in the 1995 Edition with the 1995 Addenda and later Editions and Addenda, a defect in austenitic stainless steel piping may be reduced to a flaw of acceptable size in accordance with IWB-3640 from the 1983 Edition with the Winter 1985 Addenda, or later Editions and Addenda, by deposition of weld reinforcement (weld overlay) on the outside surface of the pipe, provided the following requirements are met.	*Modification:* Code Case N-504-3 and Section XI Nonmandatory Appendix Q in the 2005 Addenda will be used for the application of Alloy 52/52M weld overlay of the ferritic (P-No. 3) nozzle material, nickel alloy (F-No. 43) weld material, and austenitic stainless steel (P-No. 8) safe end and pipe base material and (A-No. 8) weld materials, as modified herein. *Basis:* Industry operating experience has shown that PWSCC in Alloy 82/182 will arrest at the interface with stainless steel base metal, ferritic base metal, or Alloy 52/52M/152 weld metal. The 360° full structural weld overlay will control growth in any PWSCC crack and maintain weld integrity in both the Alloy 82/182 weld and the SS weld. The weld overlay will also induce inside diameter compressive stresses in the original welds, thus potentially impeding growth of any reasonably shallow cracks. Furthermore, the overlay will be sized to meet all structural requirements without considering the existing Alloy 82/182 and SS welds.
Paragraph (b): Reinforcement weld metal shall be low carbon (0.035% max.) austenitic stainless steel applied 360 deg. around the circumference of the pipe, and shall be deposited in accordance with a qualified welding procedure specification identified in the Repair Program [same as Section XI Nonmandatory Appendix Q, paragraph Q-2000(a)].	*Modification:* A nickel alloy filler material will be used in lieu of austenitic stainless steel filler material. *Basis:* The filler material used will be ERNiCrFe-7A (Alloy 52M, UNS N06054) or ERNiCrFe-7 (Alloy 52, UNS N06052). Repairs, if required, may use Alloy 52, Alloy 52M, or ENiCrFe-7 (Alloy 152, UNS W86152). Alloy 52 and Alloy 152 materials are listed in the ASME Code, Section II and Section IX as F-No. 43 and are acceptable for use under the ASME Code. Alloy 52M is assigned F-No. 43 by ASME per Code Case 2142-2. The requirements of ASME Section III, NB-2400 will continue to be applied to all filler material as required by ASME Section XI. The chromium content of Alloys 52/52M/152 is 28-31.5%. Alloy 52M contains higher Niobium content (0.5- 1 %), which improves the weldability of the material and pins the grain boundaries, thus preventing separation between the grains and hot tearing during weld puddle solidification.

Table 2: Modifications to Code Case N-504-3 and Corresponding Nonmandatory Appendix Q Requirements

Code Case N-504-3 and Nonmandatory Appendix Q	Modification and Basis
	These filler materials are selected for their improved resistance to PWSCC. Alloys 52, 52M and 152 all contain about 30% chromium (roughly twice that of Alloy 82/182), imparting excellent corrosion resistance. The existing Alloy 82/182 welds and the Alloy 52/52M overlays are austenitic and have ductile properties and toughness similar to austenitic stainless steel piping welds at PWR operating temperature. Furthermore, these filler materials are suitable for welding over the ferritic nozzle, Alloy 82/182 weld, and the austenitic stainless steel pipe, welds, and safe ends.
Paragraph (e): The weld reinforcement shall consist of a minimum of 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 least 7.5 FN shall constitute the first layer of the weld reinforcement design thickness. Alternatively, first layers of at least 5 FN may be acceptable based on evaluation [same as Q-2000(d)].	*Modification:* Delta ferrite (FN) measurements will not be performed when using Alloy 52/52M/152 filler material. The weld overlay deposit shall meet the following requirements: The austenitic nickel alloy weld overlay shall consist of at least two weld layers deposited from 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, 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 contains 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. *Basis:* Welds composed of Alloy 52/52M/152 are 100% austenitic and contain no delta ferrite due to the high nickel (~60%) content. The Alloy 52/52M filler material selected for these weld overlays is fully austenitic and is, therefore, exempt from delta ferrite content requirements. Alternatively, deposit chromium content provides a suitable alternate basis for first layer deposit acceptance in PWSCC-resistant structural weld overlays. N-504-3 and Nonmandatory Appendix Q do not identify first-layer acceptance criteria for fully austenitic deposits, however, draft ASME Code Case N-740 (and its accompanying technical justification) identify 24% chromium as an acceptable measure of first-layer deposit acceptability

Table 2: Modifications to Code Case N-504-3 and Corresponding Nonmandatory Appendix Q Requirements

Code Case N-504-3 and Nonmandatory Appendix Q	Modification and Basis
	in PWR applications. For structural weld overlays, verification of first-layer acceptability will be accomplished using the above modification. To accomplish this, first layer overlay deposit chemistry will be verified either by field chemistry measurements or by prior mockup demonstration using comparable welding parameters. When first-layer surface chemistry meets or exceeds 24% chromium, this initial layer will be credited toward structural overlay deposit thickness. If the first-layer surface chemistry chromium is less than 24% chromium, the first layer will be considered sacrificial and will not be credited toward structural overlay deposit thickness.
Paragraphs (f) and (g) and Q-3000 – Design Considerations	*Modifications:* The provisions of N-504-3 (f) and (g), Q-3000 in the 2005 Addenda of Section XI, and corrections to Q-3000 to be published in the 2006 Addenda of Section XI will be used. *Basis:* ASME Code action BC 05-1530 approved a revision to Appendix Q, which will be published in the 2006 Addenda of ASME Section XI. The explanation for this revision notes that the action was correcting wording in Nonmandatory Appendix Q, which was first published in the 2005 Addenda. It was approved as part of BC03-1658 as the incorporation of Code Case N-504-2. However, some inadvertent consequences of changed wording during the incorporation of Case N-504-2 created problems in implementation. Therefore, two corrections were approved in the revision to Appendix Q to immediately fix the problems. The correction to Q-3000(b) was to delete the requirement for the design of the overlay to satisfy the requirements of the Construction Code and Owner's requirements. There was no similar wording in Code Case N-504-2. This wording was inappropriate because meeting the requirements of the Construction Code required the absence of cracks. However, the primary purpose of the Appendix and Code Case N-504-2 was to repair cracks with the external weld overlay. The appropriate requirements for maintaining Section III (i.e., the Construction Code) limits were properly transferred from Case N-504-2 into Q-3000(b)(1) in the initial issue of Appendix Q and the deletion in Q-3000(b) resolved the problem. Regarding the correction in Q-3000(b)(3), "overlay design thickness" is more appropriate than

Table 2: Modifications to Code Case N-504-3 and Corresponding Nonmandatory Appendix Q Requirements

Code Case N-504-3 and Nonmandatory Appendix Q	Modification and Basis
	"pressure design", which is incorrect and was not used in Code Case N-504-2. Overlay design thickness is based on other loads in addition to pressure.
Paragraph *(h):* The completed repair shall be pressure tested in accordance with IWA-5000. If the flaw penetrated the original pressure boundary prior to welding, or if any evidence of the flaw penetrating the pressure boundary is observed during the welding operation, a system hydrostatic test shall be performed in accordance with IWA-5000. If the system pressure boundary has not been penetrated, a system leakage, inservice, or functional test shall be performed in accordance with IWA-5000.	*Modification:* In lieu of a hydrostatic test, a system leakage test will be performed in accordance with Section XI, IWA-5000 in the 2000 Addenda. *Basis:* A system hydrostatic test at 1.02 times Class 1 reactor coolant system operating pressure at normal operating temperature (as required by IWA-5000 and IWB-5000) is of no value. It provides no more assurance about the structural condition of the weld overlay than the system leakage test performed at Class 1 reactor coolant system operating pressure. ASME Section XI concluded this years ago and eliminated Class 1 system hydrostatic tests for inservice inspections starting in the 1993 Addenda. ASME Section XI also issued Code Case N-416-1, which was accepted by the NRC, which substituted system leakage tests for system hydrostatic tests following repairs and replacements. ASME Section XI incorporated Code Case N-416-1 into IWA-4540 in the 1999 Addenda allowing a system leakage test to be used in lieu of a system hydrostatic test. A provision of the Code Case and the incorporation of the Case required examinations to be performed as required by ASME Section III because these examinations tell much more about the condition of the repair/replacement activity than any Section XI pressure test. However, the Section III examinations are not well suited to the weld overlay configuration. For the application of weld overlays, extensive surface and volumetric examinations of the weld overlay are required by Code Case N-504-3 and Nonmandatory Appendix Q, providing equivalent assurance of the quality of the overlay as the Section III examinations.

Table 3: Modifications to Code Case N-638-1

Code Case N-638-1	Modification and Basis
Paragraph 1.0(a): The maximum area of an individual weld based on the finished surface shall be 100 sq. in., and the depth of the weld shall not be greater than one-half of the ferritic base metal thickness.	*Modification:* The maximum area of a weld overlay over the ferritic nozzle material will be 300 sq. in. The one-half base metal thickness limitation applies only to excavations and repairs, and is not applicable to weld overlays covered by this 50.55a Request. *Basis:* The surge line nozzle weld overlay will require welding on more than 100 sq. in. of the surface of the low alloy steel surge nozzle base material. The weld overlays on the remaining nozzles each have less than 100 sq. in. of welding on the surface of the low alloy steel nozzle base material. Extensive experience exists in both boiling water reactor (BWR) and PWR weld overlays applied in excess of the 100 sq. in. limitation. Additionally, industry studies into the qualification of overlays in excess of 100 sq. in., have shown no issues with shrinkage stress, weld contraction stresses, etc. A weld overlay repair having 300 sq. in. surface area was recently approved by the NRC in a letter dated June 22, 2005 for Susquehanna Steam Electric Station. Weld shrinkage caused by application of the overlays will be measured and evaluated for any system impacts, as required by Code Case N-504-3, Paragraph (g)(3).
Paragraph 4.0(b): The final weld surface and the band around the area defined in para. 1.0(d) shall be examined using a surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. The ultrasonic examination shall be in accordance with Appendix I.	*Modification:* In lieu of the ultrasonic examination requirement of paragraph 4.0(b), examinations of the final weld overlay and a band around the final weld overlay will be examined in accordance with the requirements of Code Case N-504-3 and Nonmandatory Appendix Q as indicated in Table 5. *Basis:* This Code Case applies to any type of welding where a temper bead technique is to be employed and is not specifically written for a weld overlay repair. However, for a weld overlay any major base material cracking would take place in the HAZ directly below the weld overlay or in the underlying Alloy 82/182 weld deposit and not in the required band of

Table 3: Modifications to Code Case N-638-1

	material out beyond the overlay. Therefore, if this cracking were to occur it would be identified by the ultrasonic examination of the weld overlay. This band is not in close proximity to the DM weld and if flaws in the DM weld were to propagate, they would arrest at the interface with the ferritic base material or the Alloy 52/52M/152 weld metal and be contained in the volume of material that is subject to preservice examinations. Furthermore, in Case N-638-2 ASME has removed the requirement to examine the 1.5 times the component thickness band as no longer necessary to assure acceptability. In addition, the NRC has previously granted relief on this specific issue at Millstone Unit 3 in NRC letter dated Jan. 20, 2006. With this modification, the NRC Regulatory Guide 1.147, Revision 14, condition on use of N-638-1 is not applicable and will not be applied.
Paragraph 4.0(c): Use of weld-attached thermocouples and recording instruments is not clearly stated but may be implied. When weld-attached thermocouples are used, the area from which the thermocouples have been removed shall be ground and examined using a surface examination.	*Modification:* In lieu of weld-attached thermocouples and recording instruments, process temperatures will be monitored with non-attached devices, such as contact pyrometers, which will enable manual recording of process temperatures. Instruments used will be calibrated in accordance with approved calibration and control program requirements.

Modifications to ASME Section XI, Appendix VIII Supplement 11

Appendix VIII Supplement 11 of Section XI cannot be used for nondestructive examination (NDE) qualifications of a structural weld overlay repair. Relief is requested to use the PDI program implementation of Appendix VIII Supplement 11. A detailed comparison of Appendix VIII Supplement 11 and PDI requirements is summarized below in Table 4. The bases for the proposed alternatives to Supplement 11 are noted in Table 4 except as described in the following paragraph (for broader alternatives affecting several Supplement 11 paragraphs).

To avoid confusion several instances of the term "cracks" or "cracking" were changed to the term "flaws" because of the use of alternative flaw mechanisms. The PDI program revised paragraph 2.0 to allow the overlay fabrication and base metal flaw tests to be performed separately. The PDI program also allows closer spacing of flaws provided they don't interfere with detection or discrimination. The specimens used to date for qualification to the Tri-party NRC, Boiling Water Reactor Owners Group (BWROG) and Electric Power Research Institute (EPRI) agreement have a flaw population density greater than allowed by current Code requirements. These samples have been used successfully for all previous qualifications under the Tri-party agreement program. To facilitate their use and provide continuity from the Tri-party agreement program to Supplement 11, the PDI program has merged the Tri-party test specimens into their weld overlay program.

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
1.1 SPECIMEN REQUIREMENTS	
(b) The specimen set shall consist of at least three specimens having different nominal pipe diameters and overlay thicknesses. They shall include the minimum and maximum nominal pipe diameters for which the examination procedure is applicable. Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent. If the procedure is applicable to pipe diameters of 24 in. or larger, the specimen set must include at least one specimen 24 in. or larger but need not include the maximum diameter. The specimen set must include at least one specimen with overlay thickness within -0.1 in. to +0.25 in. of the maximum nominal overlay thickness for which the procedure is applicable.	*(b)* The specimen set shall consist of at least three specimens having different nominal pipe diameters and overlay thicknesses. They shall include the minimum and maximum nominal pipe diameters for which the examination procedure is applicable. Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent. If the procedure is applicable to pipe diameters of 24 in. or larger, the specimen set must include at least one specimen 24 in. or larger but need not include the maximum diameter. The specimen set shall include specimens with overlays not thicker than 0.1 in. more than the minimum thickness, nor thinner than 0.25 in. of the maximum nominal overlay thickness for which the

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
	examination procedure is applicable. *Basis:* To avoid confusion, the overlay thickness tolerance contained in the last sentence was reworded and the phrase "and the remainder shall be alternative flaws" was added to the next to last sentence in paragraph 1.1 (d)(1).
(d) Flaw Conditions	
(1) Base metal flaws. All flaws must be cracks in or near the butt weld heat-affected zone, open to the inside surface, and extending at least 75% through the base metal wall. Flaws may extend 100% through the base metal and into the overlay material; in this case, intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the cracking. Specimens containing IGSCC shall be used when available.	(1) Base metal flaws. All flaws must be in or near the butt weld heat-affected zone, open to the inside surface, and extending at least 75% through the base metal wall. Intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws. Specimens containing IGSCC shall be used when available. At least 70 percent of the flaws in the detection and sizing tests shall be cracks and the remainder shall be alternative flaws. Alternative flaw mechanisms, if used, shall provide crack-like reflective characteristics and shall be limited by the following: (a) The use of alternative flaws shall be limited to when the implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. (b) Flaws shall be semi-elliptical with a tip width of less than or equal to 0.002 inches. *Basis:* This paragraph requires that all base metal flaws be cracks. Implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. To resolve this issue, the PDI program revised this paragraph to allow use of alternative flaw mechanisms under controlled conditions. For example, alternative flaws shall be limited to when implantation of

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
	cracks precludes obtaining an effective ultrasonic response, flaws shall be semi elliptical with a tip width of less than or equal to 0.002 inches, and at least 70% of the flaws in the detection and sizing test shall be cracks and the remainder shall be alternative flaws. To avoid confusion, the overlay thickness tolerance contained in paragraph 1.1 (b) last sentence, was reworded and the phrase, "...and the remainder shall be alternative flaws." was added to the next to last sentence. Paragraph 1.1 (d)(l) includes the statement that intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws.
(e) Detection Specimens	
(1) At least 20% but less than 40% of the flaws shall be oriented within ±20 deg. of the pipe axial direction. The remainder shall be oriented circumferentially. Flaws shall not be open to any surface to which the candidate has physical or visual access. The rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws.	(1) At least 20% but less than 40% of the base metal flaws shall be oriented within ±20 deg. of the pipe axial direction. The remainder shall be oriented circumferentially. Flaws shall not be open to any surface to which the candidate has physical or visual access. *Basis:* The requirement for axially oriented overlay fabrication flaws was excluded from the PDI Program as an improbable scenario. Weld overlays are typically applied using automated GTAW techniques with the filler metal applied in a circumferential direction. Because resultant fabrication induced discontinuities would also be expected to have major dimensions oriented in the circumferential direction axial overlay fabrication flaws are unrealistic. The requirement for using IWA-3300 for proximity flaw evaluation was excluded, instead indications will be sized based on their individual merits.
(2) Specimens shall be divided into base and over-lay grading units.	(2) Specimens shall be divided into base metal and overlay

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
Each specimen shall contain one or both types of grading units.	fabrication grading units. Each specimen shall contain one or both types of grading units. Flaws shall not interfere with ultrasonic detection or characterization of other flaws.
(a)(1) A base grading unit shall include at least 3 in. of the length of the overlaid weld. The base grading unit includes the outer 25% of the overlaid weld and base metal on both sides. The base grading unit shall not include the inner 75% of the overlaid weld and base metal overlay material, or base metal-to-overlay interface.	(a)(1) A base metal grading unit includes the overlay material and the outer 25% of the original overlaid weld. The base metal grading unit shall extend circumferentially for at least 1 in. and shall start at the weld centerline and be wide enough in the axial direction to encompass one half of the original weld crown and a minimum of 0.50" of the adjacent base material. *Basis:* The phrase, "and base metal on both sides," was inadvertently included in the description of a base metal grading unit. The PDI program intentionally excludes this requirement because some of the qualification samples include flaws on both sides of the weld. This paragraph was also modified to require that a base metal grading unit include at least 1 inch of the length of the overlaid weld, rather than 3 inches.
(a)(2) When base metal cracking penetrates into the overlay material, the base grading unit shall include the overlay metal within 1 in. of the crack location. This portion of the overlay material shall not be used as part of any overlay grading unit.	(a)(2) When base metal flaws penetrate into the overlay material, the base metal grading unit shall not be used as part of any overlay fabrication grading unit.
(a)(3) When a base grading unit is designed to be unflawed, at least 1 in. of unflawed overlaid weld and base metal shall exist on either side of the base grading unit. The segment of weld length used in one base grading unit shall not be used in another base grading unit. Base grading units need not be uniformly spaced around the specimen.	(a)(3) Sufficient unflawed overlaid weld and base metal shall exist on all sides of the grading unit to preclude interfering reflections from adjacent flaws. *Basis:* This paragraph was also modified to require sufficient unflawed overlaid weld and base metal to exist on all sides of the grading unit to preclude interfering reflections from adjacent flaws, rather than the 1 inch requirement.
(b)(l) An overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 sq. in. The overlay	(b)(l) An overlay fabrication grading unit shall include the overlay material and the base metal-to-overlay interface for a length of at

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
grading unit shall be rectangular, with minimum dimensions of 2 in.	least 1 inch. *Basis:* This paragraph was also modified to define an overlay fabrication grading unit as including the overlay material and the base metal-to-overlay interface for a length of at least 1 inch rather than the 6 inch^2 requirement.
(b)(2) An overlay grading unit designed to be unflawed shall be surrounded by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 in. around its entire perimeter. The specific area used in one overlay grading unit shall not be used in another overlay grading unit. Overlay grading units need not be spaced uniformly about the specimen.	(b)(2) Overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch at both ends. Sufficient unflawed overlaid weld and base metal shall exist on both sides of the overlay fabrication grading unit to preclude interfering reflections from adjacent flaws. The specific area used in one overlay fabrication grading unit shall not be used in another overlay fabrication grading unit. Overlay fabrication grading units need not be spaced uniformly about the specimen. *Basis:* Paragraph 1.1 (e)(2)(b)(2) states that overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch at both ends, rather than around its entire perimeter.
(b)(3) Detection sets shall be selected from Table VIII-S2-1. The minimum detection sample set is five flawed base grading units, ten unflawed base grading units, five flawed overlay grading units, and ten unflawed overlay grading units. For each type of grading unit, the set shall contain at least twice as many unflawed as flawed grading units.	(b)(3) Detection sets shall be selected from Table VIII-S2-1. The minimum detection sample set is five flawed base metal grading units, ten unflawed base metal grading units, five flawed overlay fabrication grading units, and ten unflawed overlay fabrication grading units. For each type of grading unit, the set shall contain at least twice as many unflawed as flawed grading units. For initial procedure qualification, detection sets shall include the equivalent of three personnel qualification sets. To qualify new values of essential variables, at least one personnel qualification set is required.
(f) Sizing Specimen	
(1) The minimum number of flaws shall be ten. At least 30% of the	(1) The minimum number of flaws shall be ten. At least 30% of the

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
flaws shall be overlay fabrication flaws. At least 40% of the flaws shall be cracks open to the inside surface.	flaws shall be overlay fabrication flaws. At least 40% of the flaws shall be open to the inside surface. Sizing sets shall contain a distribution of flaw dimensions to assess sizing capabilities. For initial procedure qualification, sizing sets shall include the equivalent of three personnel qualification sets. To qualify new values of essential variables, at least one personnel qualification set is required.
(3) Base metal cracking used for length sizing demonstrations shall be oriented circumferentially.	(3) Base metal flaws used for length sizing demonstrations shall be oriented circumferentially.
(4) Depth sizing specimen sets shall include at least two distinct locations where cracking in the base metal extends into the overlay material by at least 0.1 in. in the through-wall direction.	(4) Depth sizing specimen sets shall include at least two distinct locations where a base metal flaw extends into the overlay material by at least 0.1 inch in the through-wall direction.
2.0 CONDUCT OF PERFORMANCE DEMONSTRATION	
The specimen inside surface and identification shall be concealed from the candidate. All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.	The specimen inside surface and identification shall be concealed from the candidate. All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited. The overlay fabrication flaw test and the base metal flaw test may be performed separately.
2.1 Detection Test.	
Flawed and unflawed grading units shall be randomly mixed. Although the boundaries of specific grading units shall not be revealed to the candidate, the candidate shall be made aware of the type or types of grading units (base or overlay) that are present for each specimen.	Flawed and unflawed grading units shall be randomly mixed. Although the boundaries of specific grading units shall not be revealed to the candidate, the candidate shall be made aware of the type or types of grading units (base metal or overlay fabrication) that are present for each specimen.
2.2 Length Sizing Test	
(d) For flaws in base grading units, the candidate shall estimate the length of that part of the flaw that is in the outer 25% of the base wall thickness.	(d) For flaws in base metal grading units, the candidate shall estimate the length of that part of the flaw that is in the outer 25% of the base metal wall thickness.

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
2.3 Depth Sizing Test.	
For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate. For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.	(a) The depth sizing test may be conducted separately or in conjunction with the detection test. (b) When the depth sizing test is conducted in conjunction with the detection test and the detected flaws do not satisfy the requirements of 1.1(f), additional specimens shall be provided to the candidate. The regions containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region. (c) For a separate depth sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.
3.0 ACCEPTANCE CRITERIA	
3.1 Detection Acceptance Criteria.	
Examination procedures, equipment, and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls. The criteria shall be satisfied separately by the demonstration results for base grading units and for overlay grading units.	(a)Examination procedures are qualified for detection when: 1) All flaws within the scope of the procedure are detected and the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for false calls. 2) At least one successful personnel demonstration has been performed meeting the acceptance criteria defined in (b). (b) Examination equipment and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls. (c) The criteria in (a) and (b) shall be satisfied separately by the demonstration results for base metal grading units and for overlay fabrication grading units.

Table 4: Modifications to ASME Section XI, Appendix VIII Supplement 11

SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: Proposed Alternatives to Supplement 11 Requirements
	Basis: The PDI program allows procedure qualification to be performed separately from personnel and equipment qualification. Historical data indicate that, if ultrasonic detection or sizing procedures are thoroughly tested, personnel and equipment using those procedures have a higher probability of successfully passing a qualification test. In an effort to increase this passing rate, PDI has elected to perform procedure qualifications separately in order to assess and modify essential variables that may affect overall system capabilities. For a procedure to be qualified, the PDI program requires three times as many flaws to be detected (or sized) as shown in Supplement 11 for the entire ultrasonic system. The personnel and equipment are still required to meet Supplement 11.
3.2 Sizing Acceptance Criteria.	
(a) The RMS error of the flaw length measurements, as compared to the true flaw lengths, is less than or equal to 0.75 inch. The length of base metal cracking is measured at the 75% through-base-metal position.	(a) The RMS error of the flaw length measurements, as compared to the true flaw lengths, is less than or equal to 0.75 inch. The length of base metal flaws is measured at the 75% through-base-metal position.
(b) All extensions of base metal cracking into the overlay material by at least 0.1 in. are reported as being intrusions into the overlay material.	This requirement is omitted. *Basis:* The requirement for reporting all extensions of cracking into the overlay is omitted from the PDI Program because it is redundant to the RMS calculations performed in paragraph 3.2(c) and its presence adds confusion and ambiguity to depth sizing as required by paragraph 3.2(c). This also makes the weld overlay program consistent with the Supplement 2 depth sizing criteria.

Table 5: Weld Overlay Examination Requirements

IN-PROCESS EXAMINATIONS				
Examination Description	**Method**	**Technique**	**Reference**	**Acceptance Standards**
Safe end, welds, nozzle, and pipe pre-overlay surface preparation.	Surface	Liquid Penetrant	N-504-3 and Q-2000	N-504-3, Paragraph (c), Q-2000 (b)
Corrective layers of weld metal, if required, not associated with the structural weld overlay.	Surface	Liquid Penetrant	N-504-3 and Q-2000	N-504-3, Paragraph (d), Q-2000 (c)
Thickness measurements for verifying final deposited weld reinforcement.	Volumetric	UT-0°L	N-504-3 and Q-3000	Per weld overlay design requirements and Q-3000
COMPLETED WELD OVERLAY EXAMINATION and PRESERVICE EXAMINATION REQUIREMENTS				
Examination Description	**Method**	**Technique**	**Reference**	**Acceptance Standards**
Examination of the completed weld overlay and examination of a band around the entire circumference of the nozzle and pipe at least 1.5 times the nozzle end thickness outward from the toe of the weld overlay on the nozzle side and at least 0.50 inches outward from the toe of the weld overlay on the pipe side. For the portion of the weld overlay installed per Code Case N-638-1 and the band area on the nozzle side, this examination will occur at least 48 hrs. after the completed weld overlay has returned to ambient temperature.	Surface	Liquid Penetrant	N-504-3, N-638-1, and Q-4100	Q-4100 (b)
Completed weld overlay for complete bonding and minimum thickness and for detection of welding flaws. Examination for bonding and welding flaws in the portion of the weld overlay installed per Case N-638-1 will occur at least 48 hrs. after the completed weld overlay has returned to ambient temperature.	Volumetric	UT-0°L; UT angle beam per PDI-qualified procedures	N-504-3, N-638-1, Q-4100, and Appendix VIII	Thickness per weld overlay design requirements in Q-3000 and bonding and welding flaws per Q-4100(c)

Table 5: Weld Overlay Examination Requirements

Completed weld overlay and the outer 25 percent of the original DM weld thickness at least 0.5-inches beyond the toes of the original DM weld and butter and at least 0.5 inches beyond any as-found flaw. For N-638-1 welding, this examination will occur at least 48 hrs. after the completed weld overlay has returned to ambient temperature.	Volumetric	UT angle beam per PDI-qualified procedure	N-504-3, N-638-1, Q-4200, and Appendix VIII	N-504-3, Paragraph (i) and Q-4200
Completed weld overlay and the outer 25 percent of the original SS pipe weld thickness at least 0.5-inches beyond the toes of the original SS weld and at least 0.5 inches beyond any as-found flaw.	Volumetric	UT angle beam per PDI-qualified procedure	N-504-3, Q-4200, and Appendix VIII	N-504-3, Paragraph (i) and Q-4200
INSERVICE EXAMINATION REQUIREMENTS				
Examination Description	**Method**	**Technique**	**Reference**	**Acceptance Standards**
Full Structural Repair WOL: Weld overlay and outer 25 percent of the original DM weld thickness at least 0.5-inches beyond the toes of the original DM weld and butter, and at least 0.5 inches beyond any as-found flaw, will be examined within the next two refueling outages. Re-examination will be on a sampling basis in accordance with Q-4300(b) through (f) and Q-4310. These examinations will be added to the ISI Program Plan in accordance with IWB-2412(b)(1).	Volumetric	UT angle beam per PDI procedure	ASME Section XI Appendix VIII and Q-4300	Q-4300
Full Structural Repair WOL: Weld overlay and outer 25 percent of the original SS pipe weld thickness at least 0.5-inches beyond the toes of the original SS weld, and at least 0.5 inches beyond any as-found flaw, will be examined within the next two refueling outages. Re-examination will be on a	Volumetric	UT angle beam per PDI procedure	ASME Section XI Appendix VIII and Q-4300	Q-4300

Table 5: Weld Overlay Examination Requirements

sampling basis in accordance with Q-4300(b) through (f) and Q-4310. These examinations will be added to the ISI Program Plan in accordance with IWB-2412(b)(1).				
Preemptive Full Structural WOL: If greater than or equal to 90% coverage of the original DM weld is achieved with PDI qualified procedures and no PWSCC flaws are identified, the weld overlay and outer 25 percent of the original DM weld thickness at least 0.5-inches beyond the toes of the original DM weld and butter will be examined on a sampling basis in accordance with Q-4300(b) through (f) and Q-4310. These examinations and frequency of performance will be added to the ISI Program Plan in accordance with IWB-2412(b)(1).	Volumetric	UT angle beam per PDI procedure	ASME Section XI Appendix VIII and Q-4300 para. (b) through (f) and Q-4310	Q-4300(b) and (c)
Preemptive Full Structural WOL: If greater than or equal to 90% coverage of the original SS weld is achieved with PDI qualified procedures and no service related flaws are identified, the weld overlay and outer 25 percent of the original SS weld thickness at least 0.5-inches beyond the toes of the original SS weld will be examined on a sampling basis in accordance with Q-4300(b) through (f) and Q-4310. These examinations and frequency of performance will be added to the ISI Program Plan in accordance with IWB-2412(b)(1).	Volumetric	UT angle beam per PDI procedure	ASME Section XI Appendix VIII and Q-4300 para. (b) through (f) and Q-4310	Q-4300(b) and (c)