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September 28, 2005

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
ASME Section XI Relief Request to Use Weld Overlay and Associated Alternative Techniques

REFERENCE: (a) Letter from Ms. M. Gamberoni (NRC) to Mr. C. H. Cruse (BGE), dated April 5, 2000, Safety Evaluation of Proposed Alternate American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Section XI, 1998 Edition for the Third 10-Year Inspection Interval – Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (TAC Nos. MA4647 and MA4648)

Pursuant to 10 CFR 50.55a(a)(3)(i), Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP) hereby proposes alternatives to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) requirements concerning repair/replacement activities for pressure retaining welds subject to Article IWA-4000 in Section XI for the Third Ten-Year Inservice Inspection interval. Paragraph 50.55a(a)(3)(i) allows the use of alternatives to the requirements of Paragraph 50.55a(g), which provide an acceptable level of quality and safety, when authorized by the Director of the Office of Nuclear Reactor Regulation.

The Third Ten-Year Inservice Inspection Program Plan for Calvert Cliffs Units 1 and 2 meets the requirements of the 1998 Edition, no Addenda, of Section XI of the ASME Code (except for Subsections IWE and IWL), as approved by Nuclear Regulatory Commission (NRC) letter (Reference a).

RELIEF REQUEST

Article IWA-4000 of ASME Code, Section XI, and NRC approved Code Cases N-504-2 and N-638 contain the requirements for structural weld overlay repair activities for unacceptable indications in welded nozzles. Appendix VIII, Supplement 11 of Section XI contains ultrasonic examination requirements for the completed structural weld overlay repair. In lieu of these ASME Code requirements, CCNPP proposes to use alternative techniques for full structural weld overlay repair, and the examination of dissimilar metal welds with unacceptable indications in existing Alloy 82/182 welds. Relief requests have been previously approved for Calvert Cliffs Unit 2 and other licensees, including

A047

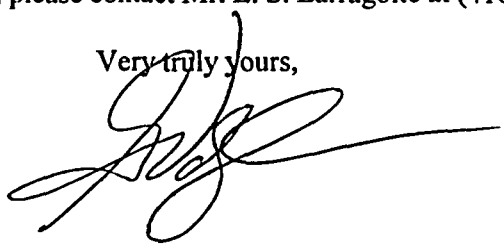
AmerGen Energy Company for its Three Mile Island Nuclear Station, Unit 1 on July 21, 2004 for most of the alternative techniques proposed in this request. The detailed relief request and the justification are provided in Attachment (1).

SCHEDULE

The structural weld overlay is intended as a contingency repair for any flaws identified during examination of dissimilar metal welds in the upcoming Calvert Cliffs Unit 1 Spring 2006 refueling outage (scheduled to begin in late February 2006) and the remainder of the third ten year inservice inspection interval for Units 1 and 2. We request that the NRC review and approve our proposed alternative for use during this outage and subsequent third interval outages.

Should you have questions regarding this matter, please contact Mr. L. S. Larragoite at (410) 495-4922.

Very truly yours,



GV/MJY/bjd

Attachment: (1) Relief Request To Use Alternative Techniques for Repair and Examination of Unacceptable Indications in Welded Nozzles

cc: P. D. Milano, NRC
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

RELIEF REQUEST TO USE ALTERNATIVE TECHNIQUES FOR REPAIR AND EXAMINATION OF UNACCEPTABLE INDICATIONS IN WELDED NOZZLES

Calvert Cliffs Nuclear Power Plant, Inc.
September 28, 2005

ATTACHMENT (1)

RELIEF REQUEST TO USE ALTERNATIVE TECHNIQUES FOR REPAIR AND EXAMINATION OF UNACCEPTABLE INDICATIONS IN WELDED NOZZLES

COMPONENT FOR WHICH RELIEF IS REQUESTED:

Class 1 dissimilar metal welds, with unacceptable indications attributed to primary water stress corrosion cracking (PWSCC) in existing Alloy 82/182 welds. These welds may include:

UNIT 1 DM WELD POPULATION					
Designator/ID	Weld Material	Nozzle Size	Location	Function	Base Material
102300/30-RC-11A-W7	182/82	30"	11A RCP Inlet	RCS Loop	A516-70/A351-CF8M
102450/30-RC-11A-W10	182/82	30"	11A RCP Outlet	RCS Loop	A516-70/A351-CF8M
104550/30-RC-11B-W7	182/82	30"	11B RCP Inlet	RCS Loop	A516-70/A351-CF8M
104700/30-RC-11B-W10	182/82	30"	11B RCP Outlet	RCS Loop	A516-70/A351-CF8M
107450/30-RC-12A-W7	182/82	30"	12A RCP Inlet	RCS Loop	A516-70/A351-CF8M
107600/30-RC-12A-W10	182/82	30"	12A RCP Outlet	RCS Loop	A516-70/A351-CF8M
109600/30-RC-12B-W7	182/82	30"	12B RCP Inlet	RCS Loop	A516-70/A351-CF8M
109750/30-RC-12B-W10	182/82	30"	12B RCP Outlet	RCS Loop	A516-70/A351-CF8M
110450/12-PSL-W1	182/82	12"	Bottom Head of PZR	PZR Surge	SA508-Cl2/ SA351-CF8M
111100/12-PSL-W13	182/82	12"	Top of 11 Hot Leg	PZR Surge	A105-GrII/ A351-CF8M
113150/12-SC-1004-W1	182/82	12"	Bottom of 12 Hot Leg	Shutdown Cooling	A105-GrII/ A351-CF8M
114350/12-SI-1009-W16	182/82	12"	Top of 11A Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
115200/12-SI-1010-W14	182/82	12"	Top of 11B Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
116000/12-SI-1011-W13	182/82	12"	Top of 12A Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
116750/12-SI-1012-W13	182/82	12"	Top of 12B Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
118500/4-PS-1003-W6	182/82	4"	Top Head of PZR	PZR Spray	SA508-Cl2/SA-182-F316
118550/3-PS-1001-W1	182/82	3"	Top of 11A Cold Leg	PZR Spray	A105-GrII/A-182-TP316
120350/3-PS-1002-W1	182/82	3"	Top of 11B Cold Leg	PZR Spray	A105-GrII/A-182-TP316
123100/4-SR-1005-W1	182/82	4"	Top of PZR	PZR Relief	SA508-Cl2/SA-182-F316
123450/4-SR-1006-W1	182/82	4"	Top of PZR	PZR Relief	SA508-Cl2/SA-182-F316
125050/2-LD-1004-W1	182/82	2"	Bottom of 12A Cold Leg	Letdown/Drain	A105-GrII/A-182-TP316
128900/2-CV-1004-W19	182/82	2"	12B Cold Leg	Charging Inlet	A105-GrII/A-182-TP316
130450/2-CV-1005-W29	182/82	2"	11A Cold Leg	Charging Inlet	A105-GrII/A-182-TP316
131200/2-DR-1003-W1	182/82	2"	Bottom of 11A Cold Leg	Loop Drain	A105-GrII/A-182-TP316
131500/2-DR-1004-W1	182/82	2"	Bottom of 11B Cold Leg	Loop Drain	A105-GrII/A-182-TP316
132150/2-DR-1006-W1	182/82	2"	Bottom of 12B Cold Leg	Loop Drain	A105-GrII/A-182-TP316

ATTACHMENT (1)

RELIEF REQUEST TO USE ALTERNATIVE TECHNIQUES FOR REPAIR AND EXAMINATION OF UNACCEPTABLE INDICATIONS IN WELDED NOZZLES

UNIT 1 DM WELD POPULATION					
Designator/ID	Weld Material	Nozzle Size	Location	Function	Base Material
132450/2-DR-1007-W1	182/82	2"	Bottom of 11 Hot Leg	Loop Drain	A105-GrII/A-182-TP316

UNIT 2 DM WELD POPULATION					
Designator/ID	Weld Material	Nozzle Size	Location	Function	Base Material
109280/30-RC-21A-W7	182/82	30"	21A RCP Inlet	RCS Loop	A516-70/A351-CF8M
109310/30-RC-21A-W10	182/82	30"	21A RCP Outlet	RCS Loop	A516-70/A351-CF8M
110280/30-RC-21B-W7	182/82	30"	21B RCP Inlet	RCS Loop	A516-70/A351-CF8M
110310/30-RC-21B-W10	182/82	30"	21B RCP Outlet	RCS Loop	A516-70/A351-CF8M
111280/30-RC-22A-W7	182/82	30"	22A RCP Inlet	RCS Loop	A516-70/A351-CF8M
111310/30-RC-22A-W10	182/82	30"	22A RCP Outlet	RCS Loop	A516-70/A351-CF8M
112280/30-RC-22B-W7	182/82	30"	22B RCP Inlet	RCS Loop	A516-70/A351-CF8M
112310/30-RC-22B-W10	182/82	30"	22B RCP Outlet	RCS Loop	A516-70/A351-CF8M
113010/12-PSL-W1	182/82	12"	Bottom Head of PZR	PZR Surge	SA508-Cl2/ SA351-CF8M
113130/12-PSL-W13	182/82	12"	Top of 21 Hot Leg	PZR Surge	A105-GrII/ A351-CF8M
114900/12-SC-2004-W1	182/82	12"	Bottom of 22 Hot Leg	Shutdown Cooling	A105-GrII/ A351-CF8M
115140/12-SI-2009-W15	182/82	12"	Top of 21B Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
116190/12-SI-2010-W13	182/82	12"	Top of 21A Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
117120/12-SI-2011-W13	182/82	12"	Top of 22B Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
118120/12-SI-2012-W13	182/82	12"	Top of 22A Cold Leg	Safety Injection	A182-F-1/ A351-CF8M
136090/4-PS-2003-W8	182/82	4"	Top Head of PZR	PZR Spray	SA508-Cl2/SA-182-F316
137010/3-PS-2001-W1	182/82	3"	Top of 21A Cold Leg	PZR Spray	A105-GrII/A-182-TP316
138010/3-PS-2002-W1	182/82	3"	Top of 21B Cold Leg	PZR Spray	A105-GrII/A-182-TP316
141000/4-SR-2005-W1	182/82	4"	Top of PZR	PZR Relief	SA508-Cl2/SA-182-F316
142000/4-SR-2006-W1	182/82	4"	Top of PZR	PZR Relief	SA508-Cl2/SA-182-F316
152440/2-CV-2005-W30	182/82	2"	21A Cold Leg	Charging Inlet	A105-GrII/A-182-TP316
156530/2-CV-2021-W34	182/82	2"	22B Cold Leg	Charging Inlet	A105-GrII/A-182-TP316
157010/2-DR-2003-W1	182/82	2"	Bottom of 21A Cold Leg	Loop Drain	A105-GrII/A-182-TP316
158010/2-DR-2004-W1	182/82	2"	Bottom of 21B Cold Leg	Loop Drain	A105-GrII/A-182-TP316
160010/2-DR-2006-W1	182/82	2"	Bottom of 22B Cold Leg	Loop Drain	A105-GrII/A-182-TP316

CODE REQUIREMENTS FOR WHICH RELIEF IS REQUESTED:

The 1998 Edition, no Addenda, of American Society of Mechanical Engineers (ASME) Section XI, Article IWA-4000 and Appendix VIII, Supplement 11 and Nuclear Regulatory Commission (NRC) approved Code Cases N-504-2 and N-638. Tables 1-4 provide the specific requirements that are included in this relief request.

PROPOSED ALTERNATIVE AND SUPPORTING INFORMATION:

For dissimilar-metal welds with unacceptable indications in existing Alloy 82/182 welds attributed to PWSCC, a full structural weld overlay modification is proposed. The nozzle material is ferritic steel (either P1 or P3 depending on the nozzle). The pipe is austenitic stainless steel (P8). The existing weld filler material is Alloy 82/182 (F43 equivalent to P43). The overlay will be designed as a full structural overlay in accordance with ASME Section XI Code Case N-504-2. The temperbead welding technique will be implemented in accordance with ASME Section XI Code Case N-638 for that portion of the overlay over ferritic base material for which the Construction Code required post-weld heat treatment. This full structural overlay will satisfy all the structural design requirements of the pipe as if the pipe were not there. The structural weld overlay (weld reinforcement) will completely cover the existing Alloy 82/182 weld metal and extend onto the ferritic and austenitic stainless steel material on each end.

Tables 1, 2, 3, and 4 provide the detailed requirements, the proposed alternatives, and the bases for the alternatives. The modification will be performed as a repair/replacement activity in compliance with Article IWA-4000 of the 1998 Edition, no Addenda, of ASME Section XI as modified and supplemented in Table 1. Certain requirements of IWA-4000, shown in Table 1, will be accomplished using the methodology of Code Case N-504-2 (Alternative Rules for Repairs of Classes 1, 2, and 3 Austenitic Stainless Steel Piping) modified as shown in Table 2, and the methodology of Code Case N-638 [Similar and Dissimilar Metal Welding using Ambient Temperature Machine GTAW (Gas Tungsten Arc Welding) Temperbead Technique] modified as shown in Table 3. Ultrasonic examination of the completed structural overlay will be accomplished in accordance with ASME Section XI, Appendix VIII, Supplement 11 modified to comply with the Performance Demonstration Initiative (PDI) program as shown in Table 4. Any applicable requirements not modified by Tables 1, 2, 3, or 4 will be met as described in IWA-4000, Appendix VIII Supplement 11, and Code Cases N-504-2 and N-638.

Code Case N-504-2 was approved for generic use in Regulatory Guide 1.147, Revision 13, and was developed for austenitic stainless steel material. An alternate application for nickel based and ferritic materials is proposed due to the specific configuration of the subject weldments. Therefore, Calvert Cliffs intends to follow the methodology of Code Case N-504-2, except for the differences identified in Table 2.

Code Case N-638 was approved for generic use in Regulatory Guide 1.147, Revision 13, and was developed for similar and dissimilar metal welding using ambient temperature machine GTAW temperbead technique. Calvert Cliffs intends to follow the methodology of Code Case N-638 for any welding on ferritic or ferritic/austenitic interfaces where the Construction Code required post-weld heat treatment, except for the differences identified in Table 3.

CONCLUSION:

Calvert Cliffs believes the proposed alternatives to Article IWA-4000, Appendix VIII, Supplement 11, and NRC approved Code Cases N-504-2 and N-638, as described in this request, provide an acceptable level of quality and safety.

Table 1

Modifications to IWA-4000

IWA-4000	Differences/Basis for Relief
IWA-4610(a) The area to be welded plus a band around the area of at least 1-1/2 times the component thickness or 5 in. (127 mm), whichever is less, shall be preheated and maintained at a minimum temperature of 350°F (177°C) for the SMAW [shielded metal arc welding] process and 300°F (149°C) for the GTAW process during welding. The maximum interpass temperature shall be 450°F (232°C). Thermocouples and recording instruments shall be used to monitor the process temperatures. Their attachment and removal shall be in accordance with Section III. **Code Case N-638** **4.0(c)** Areas from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method.	**Relief.** In lieu of weld-attached thermocouples and recording instruments, we will monitor the process temperatures with contact pyrometers and provide a manual record of the process temperatures.

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
Reply: It is the opinion of the Committee that, in lieu of the requirements of IWA-4120 in Editions and Addenda up to and including the 1989 Edition with the 1990 Addenda, in IWA-4170(b) in the 1989 Edition with the 1991 Addenda up to and including the 1995 Edition, and in IWA-4410 in the 1995 Edition with the 1995 Addenda and later Editions and Addenda, 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:	**Relief.** We propose to apply Code Case N-504-2 to the ferritic (P1 or P3) and nickel alloy (F43/P43) base material as well as the austenitic stainless steel (P8) base material. Code Case N-504-2 is accepted without restriction in the current NRC Regulatory Guide 1.147. The base material will be ferritic material (P1 or P3) with existing nickel alloy weld metal (F43/P43) to which an austenitic stainless steel (P8) pipe is welded. Industry operational experience has shown that PWSCC in Alloy 82/182 will blunt at the interface with stainless steel base metal, ferritic base metal, or Alloy 52/52M/152 weld metal. The weld overlay will put compressive stress around the weldment, thus impeding growth of any existing crack and will fulfill all structural requirements, independent of the existing weld.

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
(b) Reinforcement weld metal shall be low carbon (0.035% max.) austenitic stainless steel applied 360° around the circumference of the pipe, and shall be deposited in accordance with a qualified welding procedure specification identified in the Repair Program.	**Relief.** In lieu of austenitic stainless steel filler material, the reinforcement weld metal will be a nickel alloy. The weld metal will be either ERNiCrFe-7 (Alloy 52, UNS N06052) or ERNiCrFe-7A (Alloy 52M, UNS N06054). ENiCrFe-7 may be used to SMAW seal weld the initial base metal surfaces or to perform repair on the weld reinforcement. These weld metals are assigned F43 by ASME per Code Case 2142-2. The requirements of ASME Section III, NB-2400 will be applied to all filler material. The chromium content of Alloy 52M is 28-31.5%, identical to that of Alloy 52. The main difference in Alloy 52 is a higher Niobium content (0.5-1%). The difference in chemical composition between Alloy 52 and Alloy 52M improves weldability of the material, pinning the grain boundaries preventing separation between grains, and hot tearing during weld puddle solidification. This filler material was selected for its improved resistance to PWSCC. Alloys 52, 52M, and 152 all contain about 30% chromium that imparts excellent corrosion resistance. The existing Alloy 82/182 weld and the Alloy 52/52M overlay are austenitic and have ductile properties and toughness similar to austenitic stainless steel piping welds at pressurized water reactor operating temperature. These filler materials are suitable for welding over the ferritic nozzle, Alloy 82/182 weld and the austenitic stainless steel piping. (NOTE: ERNiCrFe-7 and ENiCrFe-7 are assigned F number 43 by the 2004 Edition of ASME Section IX. ERNiCrFe-7A (UNS N06054) is assigned F number 43 by Boiler and Pressure Vessel Code Case 2142-2.)
(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.	**Relief.** Delta ferrite (FN) measurements will not be performed for this overlay because welds of Alloy 52/52M/152 are 100% austenitic and contain no delta ferrite due to the high nickel composition (approximately 60% nickel).
(l) All other applicable requirements of IWA-4000 and IWB-4000, IWC-4000, or IWD-4000 shall be met.	**Relief.** In lieu of the ultrasonic examination acceptance criteria of the Construction Code, the following acceptance criteria will be used. Planar indication(s) detected during ultrasonic examination will be evaluated in accordance with Table IWB-3514-2 of ASME Section XI. Laminar indication(s) detected during ultrasonic examination will be evaluated in accordance with Table IWB-3514-3 of ASME Section XI, and the following:

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
	• Laminar indications not located at the pipe/overlay interface may require evaluation to IWB-3514-2. • Laminar indications shall permit examination of at least 90% of the examination volume and shall not interfere with interrogation of the base material examination volume. • The size of the lamination as it relates to the total size of the overlay. • The above acceptance criteria will be used for subsequent inservice inspection of the weld overlay(s).

Table 3

Modifications to Code Case N-638

Code Case N-638	Differences/Basis for Relief
Reply: It is the opinion of the Committee that repair to P-No. 1, 3, *except SA-302 Grade B,* 12A, 12B, and 12C material and their associated welds and P No. 8 or P No. 43 material to P-Nos. 1, 3, *except SA-302 Grade B,* 12A, 12B, and 12C material and their associated welds, may be made by the automatic or machine GTAW temperbead technique without the specified preheat or postweld heat treatment of the Construction Code, when it is impractical, for operational or radiological reasons, to drain the component, and without the NDE requirements of the Construction Code, provided the requirements of paragraphs 1.0 through 5.0, and all other requirements of IWA-4000, are met.	**Relief.** We propose to weld on non water backed as well as water backed components. The phrase "when it is impractical, for operational or radiological reasons, to drain the component" limits application to water backed components. We believe restriction to water backed components was an oversight in Code Case N-638 since Code Case N-638-1 permits non water backed applications (with no other change over Code Case N-638). Code Case N-638-1 is not yet approved for generic use in NRC Regulatory Guide 1.147. Mockups of the structural overlay will be performed on both water backed and non water backed samples to validate parameters for both situations.

Table 3

Modifications to Code Case N-638

Code Case N-638	Differences/Basis for Relief
1.0(a) The maximum area of an individual weld based on the finished surface shall be 100 in^2, and the depth of the weld shall not be greater than one-half of the ferritic base metal thickness.	**Relief.** We propose to exceed the 100 in^2 limitation when necessary. Application of Code Case N-638 will be on the ferritic portion of the base material extending onto the existing F43 buttering a minimum of 1/8 inch [to satisfy 1.0(b)]. Depending on the diameter of the nozzle to be overlaid and the axial extent of the overlay onto the ferritic material, the 100 in^2 limit may be exceeded. Additional axial extent onto the ferritic material may be necessary to facilitate ultrasonic examination and/or to ensure a smooth final nozzle contour. Studies by Structural Integrity (SI), Electric Power Research Institute (EPRI), and others indicate the 100 in^2 limitation is arbitrary and repair areas to at least 500 in^2 have no adverse effect.

Appendix VIII of Section XI cannot be used for the structural weld overlay required NDE. Relief is requested to use the PDI program implementation of Appendix VIII. A detailed comparison of Appendix VIII and PDI requirements is summarized below.

Relief is requested to allow closer spacing of flaws provided they do not interfere with detection or discrimination. The specimens used to date for qualification to the Tri-party (NRC/BWROG/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: The Proposed Alternative to Supplement 11 Requirements
1.0 SPECIMEN REQUIREMENTS	
1.1 General. The specimen set shall conform to the following 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	*(b)* ...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 examination procedure is applicable. *To avoid confusion, the overlay thickness tolerance*

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: The Proposed Alternative to Supplement 11 Requirements
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.	*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 intergranular stress corrosion cracking shall be used when available.	(1) ...must be in or... intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws. Specimens containing intergranular stress corrosion cracking shall be used when available. At least 70% 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. *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 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)(1) includes the statement that*

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: The Proposed Alternative to Supplement 11 Requirements
	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° 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° 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 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. Each specimen shall contain one or both types of grading units.	(2) Specimens shall be divided into base metal and overlay 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.

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: The Proposed Alternative to Supplement 11 Requirements
(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. *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. 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.* *Modified to require that a base metal grading unit include at least 1 in. 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. *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 in^2. The overlay grading unit shall be rectangular, with minimum dimensions of 2 in.	*(b)*(l) An overlay fabrication grading unit shall include the overlay material and the base metal-to-overlay interface for a length of at least 1 in. *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 in, rather than the 6 in^2 requirement*

Table 4

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SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS	PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements
(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 in. 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. *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 in. 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.	...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 flaws shall be overlay fabrication flaws. At least 40% of the flaws shall be cracks open to the inside surface.	(1) The .... 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 ... 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 in. in the through-wall direction.

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: The Proposed Alternative to Supplement 11 Requirements
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.....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.... (base metal or overlay fabrication) ... 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 ... base metal grading ... base metal wall thickness.
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.

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: The Proposed Alternative to Supplement 11 Requirements
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.	Examination procedures are qualified for detection when: a. 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. b. At least one successful personnel demonstration has been performed meeting the acceptance criteria defined in (c). c. 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. d. The criteria in (b) and (c) shall be satisfied separately by the demonstration results for base metal grading units and for overlay fabrication grading units.
3.2 Sizing Acceptance Criteria	
(a) The RMS [root mean squared] 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 ... base metal flaws is ... 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. *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.*