

Constellation Energy

Calvert Cliffs Nuclear Power Plant

February 18, 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), that 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 weld with unacceptable indications in existing Alloy 82/182 welds.

A047

Similar relief requests have been previously approved for other licensees including AmerGen Energy Company for its Three Mile Island Nuclear Station, Unit 1 on July 21, 2004. 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 2 Spring 2005 refueling outage (scheduled to begin in late February 2005) and the remainder of the third ten year inservice inspection interval for Units 1 and 2. We request that the Nuclear Regulatory Commission review and approve our proposed alternative for use during this outage.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



KJN/GT/bjd

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

Enclosure: Minimum Chromium Content in Nickel-Alloy Weld Overlays to Mitigate PWSCC

cc: C. W. Fleming, Esquire
J. E. Silberg, Esquire
R. V. Guzman, 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**

ATTACHMENT (1)

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

COMPONENT FOR WHICH RELIEF IS REQUESTED:

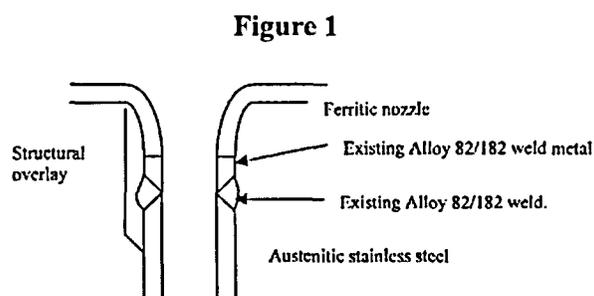
Class 1 dissimilar metal welds, with unacceptable indications attributed to primary water stress corrosion cracking (PWSCC) in existing Alloy 82/182 welds.

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. As shown in Figure 1 below, 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. Although the weld overlay will extend the full 360° around the nozzle, only half is shown in Figure 1 for clarity.



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 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.

ATTACHMENT (1)

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

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.

ATTACHMENT (1)

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

Table 1

Modifications to IWA-4000

IWA-4000	Differences/Basis for Relief
<p>IWA-4226 Reconciliation of Design Requirements IWA-4311 Material, Design, or Configuration Changes</p>	<p>Clarification. The structural weld overlay will be designed to the requirements of ASME Section XI, Code Case N-504-2 (Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping). While there is no change to the design requirements of Code Case N-504-2, we are proposing alternatives to some of the requirements as shown in Table 2.</p>
<p>IWA-4410(a) Welding, brazing, metal removal, and installation activities shall be performed in accordance with IWA-4420 or IWA-4430, and the other requirements of this Subarticle, except that the requirements of IWA-4700 shall be used for heat exchanger tube plugging or sleeving.</p> <p>IWA-4430 In lieu of the requirements of IWA-4420, the requirements of IWA-4600 may be used for alternative welding methods.</p> <p>IWA-4600(b) When postweld heat treatment is not to be performed, the following provisions may be used. (1) The welding methods of IWA-4620, IWA-4630, or IWA-4640 may be used in lieu of the welding and nondestructive examination (NDE) requirements of the Construction Code or Section III, provided the requirements of IWA-4610 are met.</p>	<p>Clarification. The Code path for welding on ferritic material and ferritic/nickel alloy interfaces where postweld heat treatment was required by the Construction Code is as follows. From IWA-4410(a), we have chosen the option of IWA-4430 from which we invoke IWA-4600. IWA-4600(b) invokes IWA-4630 (dissimilar metal weld requirements) and IWA-4610 (general requirements). We chose the methodology of Code Case N-638 as an alternative to IWA-4630. Code Case N-638 is accepted without restriction in the current NRC Regulatory Guide 1.147. Welding will be performed in accordance with IWA-4610 as modified by this Table (Table 1) and the methodology of Code Case N-638 as modified by Table 3. Welding will also meet Code Case N-504-2 as modified by Table 2.</p> <p>Clarification. If the Construction Code did not require postweld heat treatment, welding will be performed in accordance with IWA-4420 and Code Case N-504-2 as modified by Table 2. Code Case N-638 and the modifications of Table 3 would not apply.</p>
<p>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 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.</p> <p>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.</p>	<p>Clarification. IWA-4610(a) contains two general requirements, 1) preheat and interpass temperature criteria and 2) a requirement to monitor process temperatures with thermocouples and recording instruments. The preheat and interpass temperature criteria are superseded by Code Case N-638 so no Relief is requested for this requirement.</p> <p>Relief. In lieu of weld-attached thermocouples and recording instruments, we plan to monitor the process temperatures with non-attached devices, e.g., contact pyrometers or temperature indicating crayons and provide a manual record of the process temperatures.</p> <p>Code Case N-638 requires a minimum preheat temperature of 50°F and a maximum interpass temperature of 350°F. Code Case N-638 also refers to weld-attached thermocouples in paragraph 4.0(c). Due to the heat sink of the structural overlay, we believe the actual process temperatures will be comfortably within these limits and propose demonstrating this on mockups.</p>

ATTACHMENT (1)

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

Table 1

Modifications to IWA-4000

IWA-4000	Differences/Basis for Relief
	<p>The mockups will be of substantially smaller heat sink than the production weld so the mockup demonstration will be conservative, i.e., the mockups will experience greater temperature excursions than the production weld. NPS 2 overlays will most likely be water backed. NPS 4 and NPS 12 overlays will most likely not be water backed. Both water backed and non water backed applications will be evaluated on the mockups. The production weld will be monitored at regular intervals with contact pyrometers and/or temperature indicating crayons and a record will be kept. Weld-attached thermocouples would result in significant radiation dose during installation, their subsequent removal, and NDE of the attachment surfaces.</p>
<p>IWA-4422.1 Defect Removal (a) The metal removal process shall be in accordance with IWA-4421, except that thermal removal processes shall be in accordance with IWA-4460. A defect is considered removed when it has been reduced to an acceptable size. The component shall be acceptable for continued service if the resulting section thickness created by the cavity is at least the minimum required thickness. If the resulting section thickness is less than the minimum required thickness, the component shall be corrected by repair/replacement activities in accordance with this Article.</p> <p>IWA-4611 METAL REMOVAL IWA-4611.1 General Requirements (a) Defects shall be removed or reduced in size in accordance with this Paragraph. The component shall be acceptable for continued service if the resultant section thickness created by the cavity is at least the minimum design thickness. If the resulting section thickness is less than the minimum design thickness, the component shall be corrected by repair/replacement activities in accordance with this Article. Alternatively...Section III. (b) The original defect shall be removed: (2) when welding is required in accordance with IWA-4630 or IWA-4640, and the defect penetrates the base material.</p>	<p>Clarification. In lieu of the defect excavation requirements of IWA-4422.1 and IWA-4611.1, the structural overlay will be performed in accordance with Code Case N-504-2 as modified and supplemented by Table 2. IWA-4422.1 is required when temperbead welding is not used. IWA-4611.1 is required when temperbead welding is used.</p>

ATTACHMENT (1)

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

Table 1

Modifications to IWA-4000

IWA-4000	Differences/Basis for Relief
<p>IWA-4520 Examination (a) Welding or brazing areas and welded joints made for installation of items shall be examined in accordance with the Construction Code identified in the Repair/Replacement Plan.</p>	<p>Clarification. The Construction Code for this repair/replacement activity will be the methodology of Code Cases N-504-2 and N-638 modified as shown in Tables 2 and 3, respectively. Therefore, the Construction Code examination will be as described in Tables 2 and 3.</p>
<p>IWA-4540 PRESSURE TESTING OF CLASS 1, 2, AND 3 ITEMS (a) After welding on a pressure retaining boundary or installation of an item by welding or brazing, a system hydrostatic test shall be performed in accordance with IWA-5000. (b) The following may be exempted from the system hydrostatic tests: (3) piping, pump, and valve welding that does not penetrate through the pressure boundary.</p>	<p>Clarification. In lieu of the pressure testing requirements of IWA-4540, the completed structural overlay will be pressure tested in accordance with the requirements of Code Case N-504-2, paragraph (h).</p>

ATTACHMENT (1)

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

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
<p><i>Reply:</i> 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:</p>	<p>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. Calvert Cliffs plans to apply a 360°, full structural weld overlay to control growth in any PWSCC crack and maintain weld integrity. The weld overlay will put compressive stress around the weldment, thus impeding growth of any existing crack and therefore, will fulfill all structural requirements, independent of the existing weld.</p>
<p>(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.</p>	<p>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. Alloy 52MS may also be used. Alloy 52MS is a trade designation for Alloy 52M with additional cleaning requirements during manufacture and meets all requirements of Alloy 52M. The requirements of ASME Section III, NB-2400 will be applied to all filler material.</p> <p>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.</p> <p>(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.)</p>

ATTACHMENT (1)

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

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
<p>(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.</p>	<p>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).</p> <p>Relief. In lieu of the minimum two weld layers, mockups will be used to identify the first weld layer on which a 24% minimum Cr content is achieved over the ferritic, Alloy 82/182, and stainless steel base materials.</p> <p>Enclosure 1 provides justification for the 24% minimum chromium content as an effective barrier to growth of a PWSCC crack. The mockup-developed layer containing 24% minimum chromium over all three base metals will constitute the first layer of the weld reinforcement design thickness and may or may not be the second weld layer.</p> <p>It is recognized that the initial layers can be alloy rich or base material rich, depending on the welding parameters. The initial weld layer(s) will have an intermediate composition lying between that of the base material and the Alloy 52/52M/152 weld metal compositions due to dilution. The bead composition is dependent upon welding variables, such as heat input, wire feed, and travel speed. The production structural overlay will be performed with the welding parameters used in the mockups to achieve the same nominal chemical composition as in the mockups. Chemical composition testing will not be performed on the production structural overlay.</p>
<p>(i) Preservice examination of the completed repair shall be performed in accordance with IWB-2200. For all classes of components, liquid penetrant, and ultrasonic examination of the completed weld repair shall be performed. Examination procedures shall be specified in the repair program. The acceptance standards of Table IWB-3514-2 shall apply. Ultrasonic examinations shall verify the integrity of the newly applied weld reinforcement. Examinations shall also be performed to identify the original flaws in the outer 25% of the underlying pipe wall as a benchmark for subsequent examinations of the overlay. Grinding and machining of the as-welded overlay surface may be used to improve the surface finish for such examinations, when the overlay thickness is not reduced below design requirements.</p> <p>(j) Nondestructive examinations shall include the weld and volume identified in (i) above.</p>	<p>Clarification. Ultrasonic examination will be in accordance with ASME Section XI, Appendix VIII, Supplement 11, Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds as implemented through the PDI program. The Relief necessary to use the PDI overlay program is described in Table 4.</p> <p>The weld overlay will be added to the inservice inspection plan and will be ultrasonically examined during the first refueling outage following the application.</p> <p>The weld overlay will be ultrasonically examined to determine if any new or existing flaws have propagated into the upper 25% of the pipe base material or into the overlay. The angle beam will be directed perpendicular and parallel to the pipe axis, with scanning performed in four directions.</p> <p>Weld overlays that show no indication of flaw growth or new flaws will be placed into a population to be examined on a sample basis. Twenty-five percent of this population shall be examined once every ten years.</p>

ATTACHMENT (1)

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

Table 2

Modifications to Code Case N-504-2

Code Case N-504-2	Differences/Basis for Relief
	<p>If the inservice inspection examinations reveal flaw growth or new flaws, meeting the acceptance standards, the weld overlay will be re-examined during the first refueling outage following the discovery of the flaw growth or new flaws. Weld overlays that show no additional indications of flaw growth or new flaws will be re-inspected once every ten years.</p> <p>American Society of Mechanical Engineers Section XI, Appendix P represents incorporation of Code Case N-504-2 into the Code. Appendix P has not yet been approved but provides more specific guidance on preservice and inservice inspection of weld overlays than Code Case N-504-2. The above criteria is more restrictive than Appendix P in that it requires re-examination of the weld overlay the first outage following its application and when flaw growth or new flaws are found. It also requires re-examination once every ten years of all overlays when they have been found to show additional flaws or flaw growth. Appendix P would allow these flaws to be examined using a 25% sample if re-examination found flaw growth to have stopped.</p>
<p>(I) All other applicable requirements of IWA-4000 and IWB-4000, IWC-4000, or IWD-4000 shall be met.</p>	<p>Relief. In lieu of the ultrasonic examination acceptance criteria of the Construction Code, the following acceptance criteria will be used.</p> <p>Planar indication(s) detected during ultrasonic examination will be evaluated in accordance with Table IWB-3514-2 of ASME Section XI.</p> <p>Laminar indication(s) detected during ultrasonic examination will be evaluated in accordance with Table IWB-3514-3 of ASME Section XI, and the following items:</p> <ul style="list-style-type: none"> • 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).

ATTACHMENT (1)

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

Table 3

Modifications to Code Case N-638

Code Case N-638	Differences/Basis for Relief
<p><i>Reply:</i> It is the opinion of the Committee that repair to P-No. 1, 3, <i>except SA-302 Grade B</i>, 12A, 12B, and 12C material and their associated welds and P No. 8 or P No. 43 material to P-Nos. 1, 3, <i>except SA-302 Grade B</i>, 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.</p>	<p>Relief. We propose to weld on non water backed as well as water backed components.</p> <p>The phrase “when it is impractical, for operational or radiological reasons, to drain the component” limits application to water backed components. The proposed repair(s) may be to either/both water backed and non 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.</p>
<p>1.0(a) The maximum area of an individual weld based on the finished surface shall be 100 in², and the depth of the weld shall not be greater than one-half of the ferritic base metal thickness.</p>	<p>Relief. We propose to exceed the 100 in² limitation when necessary.</p> <p>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 (NPS 2, NPS 4, or NPS 12) and the axial extent of the overlay onto the ferritic material, the 100 in² 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 in² limitation is arbitrary and repair areas to at least 500 in² have no adverse effect. Activity is underway in ASME Section XI, Working Group-Welding to develop a white paper generically justifying temperbead welds of greater than 100 in².</p> <p>Clarification. We interpret the depth of the weld requirement as applicable to excavation and repair of flaws in the ferritic material. The structural overlay is to repair flaws in the Alloy 82/182 material. Use of temperbead welding is solely to facilitate extending the structural overlay onto ferritic material which would otherwise require postweld heat treatment. Extending the overlay onto ferritic material is necessary to meet the configuration requirements of</p>

ATTACHMENT (1)

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

Table 3

Modifications to Code Case N-638

Code Case N-638	Differences/Basis for Relief
	Code Case N-504-2, to enable volumetric examination, to ensure a smooth nozzle contour, and to cover the entire Alloy 82/182 surface.
4.0(b) The final weld surface and the band around the area defined in paragraph 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. ³ ³ Refer to the 1989 Edition with the 1989 Addenda and later Editions and Addenda.	Clarification. Appendix I leads to Appendix VIII. Ultrasonic examination will be in accordance with ASME Section XI, Appendix VIII, Supplement 11, Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds as implemented through the PDI program. The Relief necessary to use the PDI overlay program is described in Table 4. Ultrasonic examination is also consistent with the requirements of Code Case N-504-2 as discussed in Table 2. The 48 hour hold will be met.

ATTACHMENT (1)

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

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.

At this time, the Performance Demonstration Initiative has not qualified procedures for weld overlays less than 4 inch diameter. We propose to use the existing PDI procedures (for greater than or equal to 4 inch diameter) on weld overlays less than 4 inch diameter down to 2 inch diameter. The proposed methods of examination of weld overlays less than NPS 4 will ensure that we find any flaws of significance in the weld overlay. The basis for this conclusion is that the techniques have been demonstrated on samples of greater than and equal to 4 inch diameter weld overlays. Personnel qualified on 4 inch diameter weld overlays will be used to examine weld overlays less than 4 inch diameter. Once qualified procedures are developed for weld overlays less than 4 inch diameter, the qualified procedures will be used, along with personnel qualified on such procedures.

Relief is requested to allow 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/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 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.	
<p><i>(b)</i> 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.</p>	<p><i>(b)</i> ...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.</p> <p><i>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).</i></p>

ATTACHMENT (1)

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

Table 4

Modifications to Appendix VIII, Supplement 11

<p align="center">SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS</p>	<p align="center">PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements</p>
<p><i>(d) Flaw Conditions</i></p>	
<p><i>(1) Base metal flaws.</i> 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.</p>	<p>(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:</p> <p>(a) The use of alternative flaws shall be limited to when the implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws.</p> <p>(b) Flaws shall be semi elliptical with a tip width of less than or equal to 0.002 inches.</p> <p><i>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.</i></p> <p><i>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.</i></p> <p><i>Paragraph 1.1(d)(1) includes the statement that intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws.</i></p>

ATTACHMENT (1)

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

Table 4

Modifications to Appendix VIII, Supplement 11

<p align="center">SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS</p>	<p align="center">PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements</p>
<p><i>(e) Detection Specimens</i></p>	
<p>(1) At least 20% but less than 40% of the flaws shall be oriented within $\pm 20^\circ$ 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.</p>	<p>(1) At least 20% but less than 40% of the base metal flaws shall be oriented within $\pm 20^\circ$ 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.</p> <p><i>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.</i></p> <p><i>The requirement for using IWA-3300 for proximity flaw evaluation was excluded, Instead indications will be sized based on their individual merits</i></p>
<p>(2) Specimens shall be divided into base and over-lay grading units. Each specimen shall contain one or both types of grading units.</p>	<p>(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.</p>
<p><i>(a)(1)</i> 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.</p>	<p><i>(a)(1)</i>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.</p> <p><i>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.</i></p> <p><i>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.</i></p>

ATTACHMENT (1)

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

Table 4

Modifications to Appendix VIII, Supplement 11

<p align="center">SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS</p>	<p align="center">PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements</p>
<p>(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.</p>	<p>(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.</p>
<p>(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.</p>	<p>(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. <i>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.</i></p>
<p>(b)(1) An overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 in². The overlay grading unit shall be rectangular, with minimum dimensions of 2 in.</p>	<p>(b)(1) 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. <i>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 in² requirement</i></p>
<p>(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.</p>	<p>(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. <i>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.</i></p>

ATTACHMENT (1)

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

Table 4

Modifications to Appendix VIII, Supplement 11

<p align="center">SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS</p>	<p align="center">PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements</p>
<p>(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.</p>	<p>...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.</p>
<p><i>(f) Sizing Specimen</i></p>	
<p>(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.</p>	<p>(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.</p>
<p>(3) Base metal cracking used for length sizing demonstrations shall be oriented circumferentially.</p>	<p>(3) Base metal flaws used ... circumferentially.</p>
<p>(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.</p>	<p>(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.</p>
<p>2.0 CONDUCT OF PERFORMANCE DEMONSTRATION</p>	
<p>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.</p>	<p>The specimen.....prohibited. The overlay fabrication flaw test and the base metal flaw test may be performed separately.</p>
<p>2.1 Detection Test.</p>	
<p>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.</p>	<p>Flawed.... (base metal or overlay fabrication) ... each specimen.</p>

ATTACHMENT (1)

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

Table 4

Modifications to 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
2.2 Length Sizing Test	
<i>(d)</i> 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.	<i>(d)</i> 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.	<p><i>(a)</i> The depth sizing test may be conducted separately or in conjunction with the detection test.</p> <p><i>(b)</i> 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.</p> <p><i>(c)</i> 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.</p>
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.	<p>Examination procedures are qualified for detection when:</p> <p>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.</p> <p>b. At least one successful personnel demonstration has been performed meeting the acceptance criteria defined in (c).</p> <p>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.</p> <p>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.</p>

ATTACHMENT (1)

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

Table 4

Modifications to Appendix VIII, Supplement 11

<p align="center">SUPPLEMENT 11 – QUALIFICATION REQUIREMENTS FOR FULL STRUCTURAL OVERLAID WROUGHT AUSTENITIC PIPING WELDS</p>	<p align="center">PDI PROGRAM: The Proposed Alternative to Supplement 11 Requirements</p>
<p>3.2 Sizing Acceptance Criteria</p>	
<p>(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.</p>	<p>(a) The ... base metal flaws is ... position.</p>
<p>(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.</p>	<p>This requirement is omitted. <i>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.</i></p>

ENCLOSURE 1

**MINIMUM CHROMIUM CONTENT IN NICKEL-ALLOY WELD
OVERLAYS TO MITIGATE PWSCC**
