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AEP:NRC:6055-16
10 CFR 50.55a

Docket No. 50-315

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Unit 1
SUPPLEMENT TO PROPOSED ALTERNATIVE TO THE
AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE, SECTION XI
REPAIR REQUIREMENTS

References:

1. Letter from Joseph N. Jensen, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1, Proposed Alternative to the American Society of Mechanical Engineers Code, Section XI Repair Requirements," AEP:NRC:6055-08, Accession Number ML061710464, dated June 9, 2006.

2. Letter from Joseph N. Jensen, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1, Supplement to Proposed Alternative to the American Society of Mechanical Engineers Code, Section XI Repair Requirements," AEP:NRC:6055-12, dated September 15, 2006.

By Reference 1, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1, proposed an alternative to the repair requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) pursuant to 10 CFR 50.55a(a)(3)(i). The proposed alternative was requested because during the current CNP Unit 1 refueling outage, I&M will be performing full structural preemptive weld overlays (PWOLs) on pressurizer nozzle safe end to nozzle welds where NiCrFe Alloy 82/182 was originally used to weld the safe ends thereto.

By Reference 2, I&M supplemented the Reference 1 request. During a September 25, 2006, telephone conversation, NRC personnel requested additional information regarding the proposed alternative. Attachment 1 to this letter provides the additional information. Differences between this supplement and the Reference 2 supplement are indicated by margin marks in Attachment 1 and Attachment 2 of this letter.

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Commitments made in this letter are identified in Attachment 2. Should you have any questions, please contact Ms. Susan D. Simpson, Regulatory Affairs Manager, at (269) 466-2428.

Sincerely,

Mark A. Peifer
Site Vice President

RGV/jen

Attachments:

1. 10 CFR 50.55a Relief Request – ISIR-21, Proposed Alternative for Preemptive Weld Overlays in Accordance with 10 CFR 50.55a(a)(3)(i)
2. Regulatory Commitments

c: R. Aben – Department of Labor and Economic Growth
J. L. Caldwell – NRC Region III
K. D. Curry – AEP Ft. Wayne, w/o attachments
J. T. King – MPSC, w/o attachments
MDEQ – WHMD/RPMWS, w/o attachments
NRC Resident Inspector
P. S. Tam – NRC Washington DC

ATTACHMENT 1 to AEP:NRC:6055-16

10 CFR 50.55a RELIEF REQUEST –ISIR-21
PROPOSED ALTERNATIVE FOR PREEMPTIVE WELD OVERLAYS IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

1.0 REASON FOR THE REQUEST

Dissimilar metal welds (DMWs), consisting primarily of Alloy 82/182 weld material, are frequently used in pressurized water reactor (PWR) construction to connect stainless steel pipe and safe ends to vessel nozzles, generally constructed of carbon or low alloy ferritic steel. These welds have shown a propensity for primary water stress corrosion cracking (PWSCC) degradation, especially in components subjected to higher operating temperatures, such as the pressurizer (PRZ).

With this request, Indiana Michigan Power Company (I&M) is proposing to take a proactive approach on the Donald C. Cook Nuclear Plant (CNP) Unit 1 PRZ to apply a preemptive weld overlay (PWOL) on the PRZ nozzle safe end to nozzle DMWs to mitigate the occurrence of PWSCC prior to detectable evidence of PWSCC. Structural weld overlays (WOLs) have been used for several years on both boiling water reactors and PWRs to arrest existing flaws from propagating while establishing a new structural pressure boundary with crack-resistant material. In some cases, WOLs have been used to reestablish structural integrity of the DMW containing through wall leaking flaws. The PWOLs will also facilitate ultrasonic examination (UT) of the DMWs by providing a more consistent outer surface configuration from which scanning can be performed.

The welding will be performed using a remote machine Gas Tungsten-Arc Welding (GTAW) process and using the ambient temperature temper bead method with ERNiCrFe-7, UNS N06052 (Alloy 52) or ERNiCrFe-7A, UNS N06054 (Alloy 52M[1]) weld metal. Manual GTAW, using Alloy 52 or Alloy 52M, is only planned to be utilized subsequent to the PWOLs being essentially completed. Manual GTAW may be used if local repairs of PWOL weld defects are necessary or additional weld metal is required locally to form the final PWOL contour.

As discussed herein, there is no comprehensive criterion for a licensee to apply a WOL repair to a DMW that is constructed of Alloy 82/182 weld material and is believed to be susceptible to or contain PWSCC degradation. Although the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 1989 Edition, no Addenda, IWA-4000, is used for the CNP Unit 1 Section XI Repair/Replacement Program, it does not have the needed requirements for this type of weld overlay repair. The latest Nuclear Regulatory Commission (NRC) approved ASME Code also does not have the needed requirements for this type of overlay. Repair/replacement activities associated with WOLs of this type are required to address

[1] The material supplier's weld wire designation is 52MS. The "S" designates the process route that converts the hot-rolled billet into finished cold-drawn wire. The material properties are not affected.

the materials, welding parameters, personnel radiation exposure concerns, operational constraints, examination techniques, and procedure requirements.

2.0 ASME CODE COMPONENTS AFFECTED

Code Class:	Class 1
Code References:	ASME Section XI, 1989, no Addenda (Inservice Inspection Code) ASME Section III, 1965 Edition, including Addenda through Winter 1966 (Construction Code) ASME Section XI, 1995 Edition, including Addenda through 1996, Appendix VIII, Supplement 11 (Qualification Requirements) ASME Section III, 1998 Edition, including Addenda through 2000 (Repair and Inspection Code) ASME Code Case N-416-1 (Hydrostatic Testing Alternatives) ASME Code Case N-460 (Examination Coverage) ASME Code Case N-504-2 (Weld Overlay)
Examination Categories:	B-F and B-J
Item Numbers:	B5.40 and B9.11
Description:	PWOLs for PRZ Spray, Safety, Relief and Surge Nozzle Safe End to Nozzle DMWs and PWOLs for the Elbow to Safe End Welds
Component Number:	1-PRZ-20 1-PRZ-21 1-PRZ-22 1-PRZ-24 1-PRZ-25 1-RC-5-05F 1-RC-6-01F 1-RC-7-01F 1-RC-8-01F 1-RC-10-39F

3.0 GENERAL DESCRIPTION

CNP Unit 1 is in the third ten-year inservice inspection interval using the 1989 Edition of Section XI of the ASME Code. Section XI, IWA-4120, states:

> (a) "Repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later Editions and Addenda of the Construction Code or of Section III, either in their entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4500 and the following may be used:..."

The original construction code for the PRZ is ASME Code, Section III, 1965 Edition, Class A, including Addenda through Winter 1966 for CNP Unit 1. The 1998 Edition, ASME Code Section III, including Addenda through 2000, would require welding in accordance with NB-4622.11, "Temper Bead Weld Repair to Dissimilar Metal Welds or Buttering."

4.0 APPLICABLE CODE REQUIREMENTS FOR WHICH RELIEF IS REQUESTED

1. ASME Section XI, 1989 Edition, no Addenda, IWA-4500.

2. Not Used.

3. NRC conditionally-approved Code Case N-504-2 with the condition as specified in RG 1.147, Revision 14.

4. ASME Section XI, 1995 Edition including Addenda through 1996, Appendix VIII, Supplement 11.

5.0 PROPOSED ALTERNATIVE SUMMARY AND BASIS FOR USE

I&M proposes using PWOLs designed in accordance with Code Case N-504-2 (Reference 1) with the modifications proposed in Table 1. Code Case N-504-2, which the NRC finds acceptable if ASME Section XI, 2005 Addenda, Appendix Q, requirements are met, allows a flaw to be reduced to an acceptable size by deposition of weld reinforcement on the outside surface of the pipe without flaw removal. The PWOLs will extend around the full circumference of the applicable DMWs as required by Code Case N-504-2. The specific thickness and length will be determined according to the guidance provided in Code Case N-504-2. The overlay will completely cover the DMWs and the adjacent stainless steel safe end to pipe welds with Alloy 52 or Alloy 52M material that is highly resistant to PWSCC. A typical PWOL configuration is shown in Figure 1.

The temper bead welding technique for the specified nozzles connecting DMWs will be implemented using an alternate methodology similar to that described in Code Case N-638-1. The differences between the Code Case N-638-1 methodology and the proposed alternative are described in Table 2. The ultrasonic examination (UT) of the completed PWOL will be accomplished in accordance with ASME Section XI, 1995 Edition with the 1996 Addenda, Appendix VIII, Supplement 11, with the modifications described in Table 3 used to comply with the Performance Demonstration Initiative (PDI) program.

6.0 DURATION OF THE PROPOSED ALTERNATIVE

The proposed alternative to apply PWOLs over the welds identified in Section 2 is requested for the Unit 1, Cycle 21 refueling outage that began on September 16, 2006. Should I&M choose to not apply PWOLs on any or all of the welds identified in Section 2, additional approvals from the NRC will be required.

The duration of the proposed alternative for all PWOLs installed during the Unit 1, Cycle 21 refueling outage is for the life of the plant,including the period of extended operation.

7.0 PRECEDENTS

Similar relief requests have been previously approved for AmerGen Energy Company for its Three Mile Island Nuclear Station, Unit 1 (Reference 3), Constellation Energy's Calvert Cliffs Nuclear Power Plant, Unit 2 (Reference 4), CNP Unit 1 (References 5 and 6), PPL Susquehanna, LLC's Susquehanna Steam Electric Station, Unit 1 (Reference 7), and Dominion Nuclear Connecticut's Millstone Power Station Unit 3 (Reference 8). These requests were associated with welding over detected flaws outside the acceptance criteria of Section XI.

A similar CNP Unit 2 request (Reference 9) was verbally approved for the CNP Unit 2, Cycle 16 refueling outage.

8.0 CONCLUSION

It is I&M's opinion that the application of PWOLs using the proposed alternative to the ASME Code and the use of PDI provide an acceptable level of quality and safety in accordance with the requirements of 10 CFR 50.55a(3)(i).

9.0 REFERENCES

1. ASME Code Case N-504-2, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping," dated March 12, 1997.
2. Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," dated February 13, 2003.
3. 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, Heat Treatment, and Nondestructive Examination Requirements for the Third 10-year Inservice Inspection (ISI) Interval (TAC No. MC101)," Accession Number ML041670510, dated July 21, 2004.
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 L. Raghavan, NRC, to Mano K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Unit 1 (DCCNP-1) – Alternatives Regarding Repair of Weld 1-PZR-23 on Pressurizer Nozzle to Valve Inlet Line (TAC No. MC6704)," Accession Number ML053220019, dated December 1, 2005.
6. 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. MC6751)," Accession Number ML051720006, dated June 27, 2005.

7. 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.

8. Letter from Darrell J. Roberts, NRC, to David A. Christian, Dominion Nuclear Connecticut, "Millstone Power Station, Unit No. 3 – Issuance of Relief from Code Requirements (TAC No. MC8609)

9. Letter from Joseph N Jensen, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Unit 2, Proposed Alternative to the American Society of Mechanical Engineers Code, Section XI Repair Requirements, Request for Additional Information," AEP:NRC:6055, Accession Number ML060620063, dated March 1, 2006.

10. Letter from John N. Hannon, NRC, to E. E. Fitzpatrick, I&M, "D. C. Cook, Units 1 and 2, Requesting Approval of Code Case N-416-1 as an alternative to the Required Hydrostatic Pressure Test (TAC Nos. M92377 and M92345)," dated July 24, 1995.

11. "Materials Reliability Program: Technical Basis for Preemptive Weld Overlays for Alloy 82/182 Butt Welds in PWRs (MRP-169)," Electric Power Research Institute, September 2005.

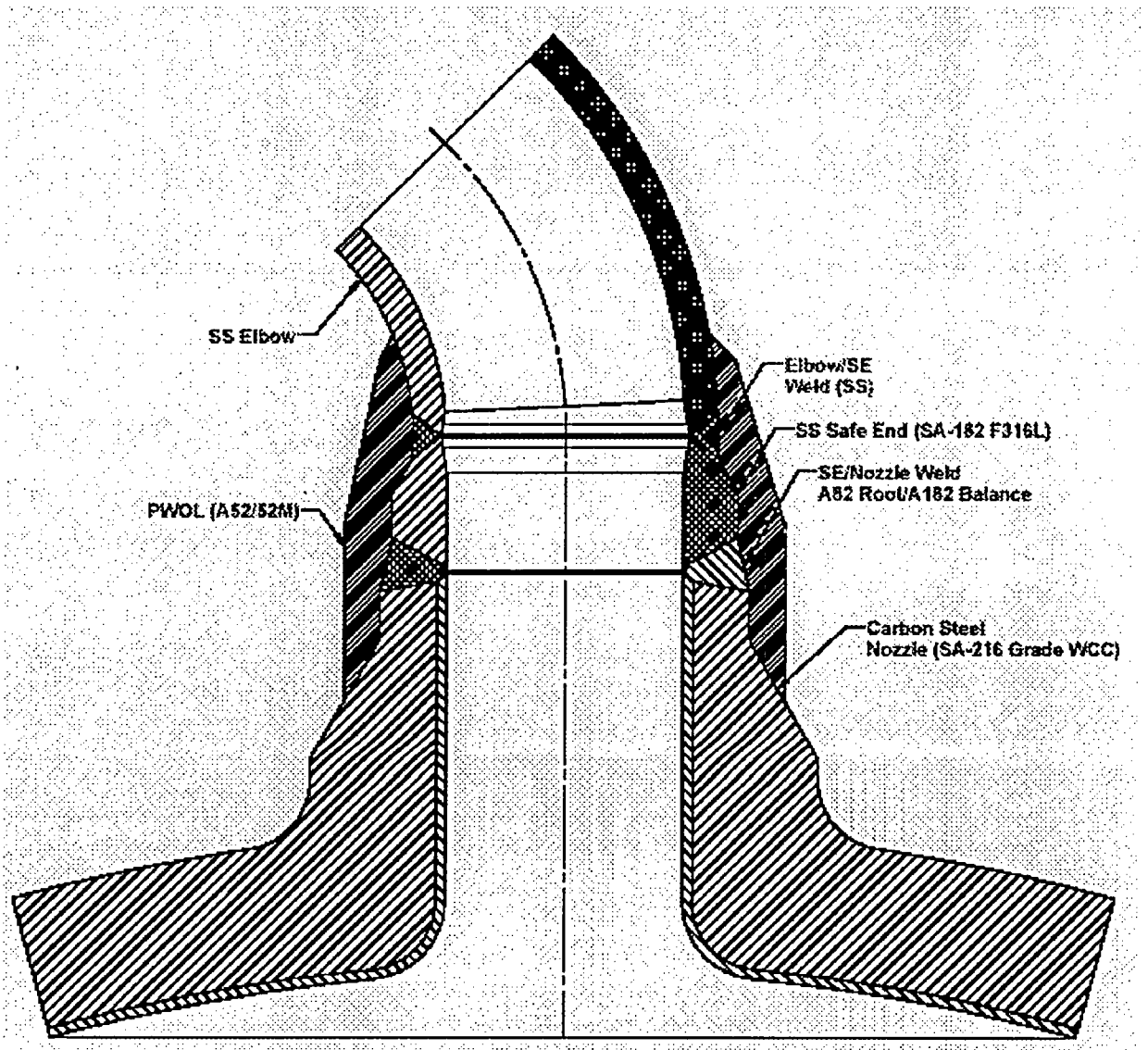
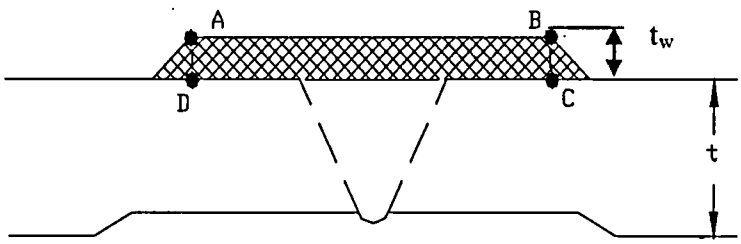


Figure 1 - Typical PWOL Configuration



Examination Volume A-B-C-D

Figure 2
Acceptance Examination Volume

TABLE 1
DESIGN/MATERIAL/NONDESTRUCTIVE EXAMINATION
Modifications to Code Case N-504-2 and ASME Section XI, Appendix Q

Code Case N-504-2 and ASME Section XI Appendix Q	Proposed Modifications
(b) Reinforcement weld metal shall be low carbon (0.035% **[percent]** maximum) austenitic stainless steel applied 360 degrees around the circumference of the pipe, and shall be deposited in accordance with a qualified welding procedure specification identified in the Repair Program **[essentially same as Q-2000(a)]**.	**Modification:** Weld overlay filler metal shall be an austenitic nickel alloy (28% Cr minimum) applied 360 degrees around the circumference of the item, and shall be deposited using a Welding Procedure Specification for groove welding, qualified in accordance with the Construction Code and Owner's Requirements and identified in the Repair/Replacement Plan. **Basis:** Industry operational experience has shown that PWSCC in Alloy 82/182 will blunt at the interface with stainless steel base metal, ferritic steel base metal, or Alloy 52/52M/152 weld metal.
(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 at 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 **[essentially the same as Q-2000(d) except if 0.02% carbon is used, evaluation of 5 FN acceptability not required]**.	**Modification:** There is no requirement for delta ferrite, and delta ferrite measurements will not be performed for this overlay. **Basis:** The deposited Alloy 52 or Alloy 52M weld metal is 100% austenitic and contains no delta ferrite due to the high nickel composition (approximately 60% nickel).
(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 hydrostatic testing, a system leakage test and a UT of the weld overlay shall be performed in accordance with the Third Interval ISI Program and ASME Code Case N-416-1. **Basis:** Code Case N-416-1 has been approved for use at CNP as an alternative to hydrostatic testing (Reference 10).

Code Case N-504-2 and ASME Section XI Appendix Q	Proposed Modifications
The repair shall be performed in accordance with a Repair Program satisfying the requirements of IWA-4000 in the Edition and Addenda of Section XI applicable to the plant in-service inspection program, or later Edition and Addenda.	See Table 2.

TABLE 2
AMBIENT TEMPERATURE TEMPER BEAD WELDING
Code Case N-638-1 and Proposed Alternative Methodology Differences

Code Case N-638-1	Proposed Alternative
1.0 GENERAL REQUIREMENTS	
(a) The maximum area of an individual weld based on the finished surface shall be 100 square inches, and the depth of the weld shall not be greater than one-half of the ferritic base metal thickness.	The maximum area of an individual weld based on the finished surface over the ferritic material shall be 300 square inches. **Basis:** The PWOL will require welding on more than 100 square inches of surface on the surge nozzle carbon steel base material. The PWOL will extend to the transition taper of the carbon steel nozzle so that qualified UT of the required volume can be performed There have been a number of temper bead WOL repairs applied to safe-end to nozzle welds in the nuclear industry, and a WOL repair having a 300 square inch surface was recently approved for the Susquehanna Steam Electric Station (Reference 7). ASME Code Case N-432-1, which is approved for use in RG 1.147, allows temper bead welding on carbon and low alloy ferritic steel nozzles without limiting the temper bead weld surface area. The two additional conditions required by Code Case N-432-1 that are not required by Code Case N-638-1 are that temper bead welds have preheat applied and that the procedure qualification be performed on the same specification, type, grade, and class of material. The elevated preheat would present a radiation exposure burden when performing the repair.
4.0 EXAMINATION	
(b) The final weld surface and the band around the area defined in paragraph 1.0(d) shall be examined using 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:** For the PWOLs, UT of the 1.5T band will not be performed. **Basis:** For the application of the PWOL repair addressed in this request, it is not practical to perform a meaningful UT of the required band of base material because of the existing nozzle configuration shown in Figure 1. This Code

Code Case N-638-1	Proposed Alternative
	Case applies to any type of welding where a temper bead technique is to be employed and is not specifically written for a WOL repair. Experience from CNP Unit 2 shows the 1.5T examination causes increased dose, outage time, and cost without a commensurate increase in safety. The base material is cast carbon steel and not subject to weld stress residual cracking. Indications in this type of material are generally casting inclusions which preclude meaningful examination. IWA-4534 requires UT of the weld region only. The Code Case requirements are based on repair to material with flaws that have been removed prior to welding thereon. Therefore, there is a concern for other incipient or existing flaws in the immediate area which may not have been properly cleared prior to welding possibly increasing in size as a result of welding. The first purpose of the examination is to detect flaws that may be revealed as a result of the repair. In this case, there are no known flaws in the ferritic steel base metal that is being repaired. For the PWOL, the primary potential concern would be flaws occurring in the heat affected zone adjacent to and beneath the weld in the nozzle carbon steel base material due to welding thereon. UT examination of the PWOL (welded region) will be performed. Dye penetrant examination of both the weld and 1.5T band on the ferritic steel nozzle will be performed. This is sufficient to verify that defects have not been induced in the ferritic carbon steel nozzle material due to the welding process.
	Acceptance Examination The examination volume in Figure 2 shall be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base metal and to detect welding flaws, such as interbead lack of fusion, inclusions, or cracks. The interface C-D shown between the overlay and

Code Case N-638-1	Proposed Alternative
	the weld includes the bond and the heat affected zone from the overlay. For ambient temperature temper bead welding, the ultrasonic examination shall be conducted at least 48 hours after the completed overlay has returned to ambient temperature. Planar flaws shall meet the preservice examination standards of Table IWB-3514-2. In applying the acceptance standards, wall thickness "t_w" shall be the thickness of the weld overlay. Laminar flaws shall meet the following: Laminar flaws shall meet the acceptance standards of Table IWB-3514-3 with the additional limitation that the total laminar flaw shall not exceed 10 percent of the weld surface area and that no linear dimension of the laminar flaw area exceeds 3.0 inches. The reduction in coverage of the examination volume in Figure 2 due to laminar flaws shall be less than 10 percent. The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the overlay. Any uninspectable volume in the weld overlay shall be assumed to contain the largest radial planar flaw that could exist within that volume. This assumed flaw shall meet the preservice examination standards of Table IWB-3514-2. Alternately, the assumed flaw shall be evaluated and shall meet the requirements of IWB-3640. Both axial and circumferential planar flaws shall be assumed. **Basis:** The weld overlay covers both ferritic and austenitic material. Temperbead welding will be used on the portion of the weld covering the ferritic material. The weld overlay on the ferritic material performs the same structural function as the overlay on the austenitic portion. The acceptance criteria proposed for the temperbead weld area is the same acceptance criteria that is

Code Case N-638-1	Proposed Alternative
	used for the balance of the weld overlay. The design function of both portions of the weld overlay is the same. Weld overlay shrinkage exerts a radial compressive force on the underlying component. The compressive force is resolved in the overlay as a circumferential tension load. This is analogous to the wire winding used in very high pressure vessels. The wire is wound around the component to produce high initial prestress (compressive stress). The overlay weld has two dimensional continuity and small discontinuities do not affect the overall strength of the weld. These small discontinuities are generally not acceptable in the American Society of Mechanical Engineers (ASME) Code, Section III, NB-5330 but do not affect the weld overlay. The acceptance criteria for the overlay welds were developed for overlay work from the boiling water reactor (BWR) experience, notably Code Case N-504-2. NUREG-0313, Revision 2, provides an overall approach to Intergranular Stress Corrosion Cracking in BWRs. The acceptance criteria use the sizing tables in IWB-3641 for the underlying weld. There is no specific reference to the ASME Code, Section III for these repairs. MRP-169 (Reference 11), Section 8 discusses the residual stresses with examples. These examples show the residual stresses are compressive and support the assumption of a two dimensional tension field in the overlay. The proposed acceptance criteria limit the indications to sizes that can be accommodated in this design assumption. ASME Code, Section XI defines laminar flaws as those flaws within 10 degrees of the plane parallel to the surface of the pipe. Planar Flaws are limited to those flaws in Table IWB-3514-2. The overlay thickness ranges from approximately 0.520 inches for the surge line down to approximately 0.332 inches for the spray line. These thicknesses do not permit large planar flaws.

Code Case N-638-1	Proposed Alternative
	Also any laminar flaw is assumed to hide the largest planar flaw that would fit beneath it.

TABLE 3
Modifications to Appendix VIII, Supplement 11

Appendix VIII, Supplement 11	PDI Modification
1.0 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 inches or larger, the specimen set must include at least one specimen 24 inches or larger but need not include the maximum diameter. The specimen set must include at least one specimen with overlay thickness within -0.1 inches to +0.25 inches 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 inches or larger, the specimen set must include at least one specimen 24 inches or larger but need not include the maximum diameter. The specimen set shall include specimens with overlays not thicker than 0.1 inches more than the minimum thickness, nor thinner than 0.25 inches of the maximum nominal overlay thickness for which the examination procedure is applicable.
(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 **[intergranular stress corrosion cracking]** 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% 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:

Appendix VIII, Supplement 11	PDI Modification
	(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 semielliptical with a tip width of less than or equal to 0.002 inches.
(e) Detection Specimens	
(1) At least 20% but less than 40% of the flaws shall be oriented within ±20 degrees 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 degrees 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.
(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.
(a)(1) A base grading unit shall include at least 3 inches 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 inch 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 inch of the adjacent base material.
(a)(2) When base metal cracking penetrates into the overlay material, the base grading unit shall include the overlay metal within 1 inch 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.

Appendix VIII, Supplement 11	PDI Modification
(a)(3) When a base grading unit is designed to be unflawed, at least 1 inch 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.
(b)(l) An overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 square inches The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches.	(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 inch.
(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 inch 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.
(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.

Appendix VIII, Supplement 11	PDI Modification
(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 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 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 inch 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.

Appendix VIII, Supplement 11	PDI Modification
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.
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. (a) At least one successful personnel demonstration has been performed meeting the acceptance criteria defined in (b).

Appendix VIII, Supplement 11	PDI Modification
3.2 Sizing Acceptance Criteria.	(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 resul`ts for base metal grading units and for overlay fabrication grading units.
(a) The RMS **[root mean square]** 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 inch are reported as being intrusions into the overlay material.	This requirement is omitted.
(c) The RMS error of the flaw depth measurements, as compared to the true flaw depths, is less than or equal to 0.125 inch.	(b) The RMS error of the flaw depth measurements, as compared to the true flaw depths, is less than or equal to 0.125 inch.

Attachment 2 to AEP:NRC:6055-16

REGULATORY COMMITMENTS

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this document. Any other actions discussed in this submittal represent intended or planned actions by I&M. They are described to the Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

Commitment	Date
I&M will complete stress analysis summaries of the preemptive weld overlay prior to restart of Unit 1 and provide the summaries within four weeks after restart from the Unit 1 (Fall 2006) refueling outage.	Within 4 weeks after restart of Unit 1 from the Fall 2006 refueling outage.
I&M will provide the Preemptive Weld Overlay ultrasonic examination results to the NRC. The results will include: • a listing of indications detected • the disposition of all indications using the standards of the American Society of Mechanical Engineers Code, Section XI, IWB-3514-2 and/or IWB-3514-3 criteria and, if possible, • the type and nature of the indications. Also included in the results will be a discussion of any repairs to the overlay material and/or base metal and the reason for the repair.	Within 14 days after the completion of the last ultrasonic examination of the weld overlays.