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INDIANA MICHIGAN POWER

December 6, 2001

C1201-02
10 CFR 50.55a

Docket Nos. 50-315
50-316

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

Donald C. Cook Nuclear Plant Units 1 and 2
PROPOSED ALTERNATIVES TO THE REQUIREMENTS OF SECTION XI OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE

Pursuant to 10 CFR 50.55a(a)(3)(i) and 10 CFR 50.55a(a)(3)(ii), Indiana Michigan Power Company (I&M), the licensee for the Donald C. Cook Nuclear Plant (CNP), is proposing two alternatives to the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code).

During the next CNP Unit 1 and Unit 2 refueling outages, I&M will be conducting inspections of the reactor vessel head penetrations (VHPs) in accordance with Nuclear Regulatory Commission Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." In accordance with 10 CFR 50.55a(a)(2), systems and components of pressurized water-cooled nuclear power reactors must meet the requirements of the ASME Code. I&M is proposing two alternatives to the requirements of Section XI of the ASME Code for repair of flaws that may be identified during these inspections.

The first alternative is proposed under the provisions of 10 CFR 50.55a(a)(3)(ii). Under this provision, licensees may propose alternatives to the requirements of 10 CFR 50.55a if they demonstrate that compliance with the specified requirements result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. The proposed alternative would allow use of an ambient temperature automatic or machine gas tungsten arc weld temper bead process for certain repairs to J-groove welds on VHPs. This

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process would be used as an alternative to the requirements in ASME Code, Section XI, that manual shielded metal arc welding be used, that the crown of the first weld layer be removed by grinding or machining, and that the completed weld be heat treated and undergo liquid penetrant inspection and radiography. The proposed alternative is presented in Attachment 1 to this letter. Similar alternatives have been approved for North Anna Power Station Unit 2, and Turkey Point Unit 3 as described in Attachment 1.

The second alternative is proposed under the provisions of 10 CFR 50.55a(a)(3)(i). Under this provision, licensees may propose alternatives to the requirements of 10 CFR 50.55a if they demonstrate that the proposed alternative would provide an acceptable level of quality and safety. The proposed alternative would allow use of an embedded flaw repair technique for repairs to J-groove welds on VHPs. This technique would be used as an alternative to the requirements in ASME Code, Section XI, that preclude welding over or embedding an existing flaw. The proposed alternative is presented in Attachment 2 to this letter. Similar alternatives have been approved for North Anna Power Station Unit 2, and for base metal repairs at CNP as described in Attachment 2.

I&M requests approval of the proposed alternatives by January 15, 2002, to support VHP inspections scheduled for the next Unit 2 refueling outage.

This letter contains no new commitments. Should you have any questions, please contact, Mr. Ronald W. Gaston, Manager of Regulatory Affairs, at (616) 697-5020.

Sincerely,

S. A. Greenlee
Director, Nuclear Technical Services

/bjb

Attachments

c: J. E. Dyer
MDEQ – DW & RPD, w/o attachments
NRC Resident Inspector
R. Whale, w/o attachments

ATTACHMENT 1 TO C1201-02

Relief Request ISI-2001-01

PROPOSED ALTERNATIVE TO AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) CODE, SECTION XI

COMPONENT IDENTIFICATION

Code Class:	1
References:	1989 ASME Code, Section III, NB-4622.9 1989 ASME Code, Section XI, IWA-4120, IWA-4500
Examination Category:	B-E
Item Numbers:	B4.12
Description:	Alternative welding process for repairing reactor pressure vessel head penetration (VHP) J-groove welds located on the interior of the head. The alternative consists of an ambient temperature automatic or machine gas tungsten arc weld (GTAW) temper bead process.
Component Numbers:	1-OME-1, Donald C. Cook Nuclear Plant (CNP) Unit 1 Reactor Pressure Vessel (79 penetrations) 2-OME-1, CNP Unit 2 Reactor Pressure Vessel (78 penetrations)

CODE REQUIREMENT

CNP Units 1 and 2 are in the third ten-year inservice inspection interval using the 1989 Edition of Section XI of the ASME Code. ASME Code, Section XI, IWA-4120, "Rules and Requirements," 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 codes for the reactor pressure vessel were ASME Code, Section III, 1965 Edition through 1966 Winter Addenda for Unit 1, and ASME Code, Section III, 1968 Edition through 1968 Summer Addenda for Unit 2. The 1989 Edition of the ASME Code would require repair in accordance with Section III, NB-4622.9, "Temper Bead Weld Repair." For repair of flaws in reactor vessel head penetration J-groove attachment welds when 1/8 inch or less of nonferritic weld deposit exists above the original fusion line, the requirements described in ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500, "Repair Welding," would involve the establishment and maintenance of minimum preheat temperatures of 350 degrees Fahrenheit (°F) and 300°F, respectively. These sections also impose a 450°F maximum interpass temperature and only allow the use of the manual shielded metal arc welding (SMAW) process. The first layer of deposited weld metal must have the weld crown removed by grinding or machining prior to deposition of subsequent layers. The completed weld requires a post-weld soak at 450°F to 550°F for a minimum of 2 hours after welding. Final non-destructive examination (NDE) of the repair requires liquid penetrant inspection and radiography, with ultrasonic inspection, if practical.

PROPOSED ALTERNATIVE

Repairs to reactor vessel head penetration J-groove attachment welds when 1/8 inch or less of nonferritic weld deposit exists above the original fusion line will be made by the ambient temperature automatic or machine GTAW temper bead process described in Sections 1.0 through 5.0 below in lieu of the requirements of ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500. All other applicable requirements of Section XI, IWA-4000, "Repair Procedures" in the 1989 Edition of the ASME Code will be met.

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.

(b) Repair activities on a dissimilar metal weld in accordance with this procedure shall be limited to those along the fusion line of a nonferritic weld to ferritic base material on which 1/8 inch or less of nonferritic weld deposit exists above the original fusion line.

(c) If a defect penetrates into the ferritic base material, repair of the base material, using a nonferritic weld filler material, may be performed in accordance with these requirements, provided the depth of repair in the base material does not exceed 3/8 inch.

(d) Prior to welding, the area to be welded and a band around the area of at least 1-1/2 times the component thickness or 5 inches, whichever is less, shall be at least 50°F.

(e) Welding materials shall meet the owner's requirements and the construction code and cases specified in the Repair/Replacement Plan. Welding materials shall be controlled so that they are identified as acceptable until consumed.

(f) Peening may be used, except on the initial and final layers.

2.0 WELDING QUALIFICATIONS

The welding procedures and the welding operators shall be qualified in accordance with the 1989 Edition of ASME Code, Section XI, IWA-4000, and the requirements of Subsections 2.1 and 2.2 below.

2.1 Procedure Qualification

(a) The base materials for the welding procedure qualification shall be of the same P-number and group number as the materials to be welded. The materials shall be post-weld heat treated for at least the time and temperature that was applied to the materials being welded.

(b) Consideration shall be given to the effects of irradiation on the properties of material. Special material requirements in the design specification shall also apply to the test assembly materials for these applications.

(c) The root width and included angle of the cavity in the test assembly shall be no greater than the minimum specified for the repair.

(d) The maximum interpass temperature for the first three layers of the test assembly shall be 150°F.

(e) The test assembly cavity depth shall be at least one-half the depth of the weld to be installed during the repair/replacement activity and at least 1 inch. The test assembly thickness shall be at least twice the test assembly cavity depth. The test assembly shall be large enough to permit removal of the required test specimens. The test assembly dimensions surrounding the cavity shall be at least the test assembly thickness and at least 6 inches. The qualification test plate shall be prepared in accordance with Figure 1 of this attachment.

(f) Ferritic base material for the procedure qualification test shall meet the impact test requirements of the construction code and owner's requirements. If such requirements are not in the construction code and owner's requirements, the impact properties shall be determined by Charpy V-notch impact tests of the procedure qualification base material at or below the lowest service temperature of the item to be repaired. The location and orientation of the test specimens shall be similar to those required in (h) below, but shall be in the base metal.

(g) Charpy V-notch tests of the ferritic weld metal of the procedure qualification shall meet the requirements as determined in (f) above.

(h) Charpy V-notch tests of the ferritic heat-affected zone (HAZ) shall be performed at the same temperature as the base metal test of (f) above. The number, location, and orientation of test specimens shall be as follows:

(1) The specimens shall be removed from a location as near as practical to a depth of one-half the thickness of the deposited weld metal. The coupons for HAZ impact specimens shall be taken transverse to the axis of the weld and etched to define the HAZ. The notch of the Charpy V-notch specimen shall be cut approximately normal to the material surface in such a manner as to include as much HAZ as possible in the resulting fracture. When the material thickness permits, the axis of a specimen shall be inclined to allow the root of the notch to be aligned parallel to the fusion line.

(2) If the test material is in the form of a plate or a forging, the axis of the weld shall be oriented parallel to the principal direction of rolling or forging.

(3) The Charpy V-notch test shall be performed in accordance with the American Society of Testing Materials Standard SA-370. Specimens shall be in accordance with SA-370, Figure 11, Type A. The test shall consist of a set of three full-size 10 mm x 10 mm specimens. The lateral expansion, percent shear, absorbed energy, test temperature, orientation and location of all test specimens shall be reported in the procedure qualification record.

(i) The average values of the three HAZ impact tests shall be equal to or greater than the average of the three unaffected base metal tests.

2.2 Performance Qualification

Welding operators shall be qualified in accordance with the 1989 Edition of ASME Code, Section XI, IWA-4000.

3.0 WELDING PROCEDURE REQUIREMENTS

The welding procedure shall include the following requirements:

(a) The automatic or machine GTAW process shall deposit the weld metal.

(b) Dissimilar metal welds shall be made using F-43 weld metal (QW-432) for P-43 to P-3 weld joints.

(c) The area to be welded shall be buttered with a deposit of at least three layers to achieve at least 1/8 inch overlay thickness, as shown in Figure 2 of this attachment, Steps 1 through 3, with the heat input for each layer controlled to within ± 10% of that used in the procedure qualification test. Particular care shall be taken in placement of the weld layers at the weld toe area of the ferritic material to ensure that the HAZ and ferritic weld metal are tempered. Subsequent layers shall be deposited with a heat input not exceeding that used for layers beyond the third layer in the procedure qualification.

(d) The maximum interpass temperature for field applications shall be 350°F regardless of the interpass temperature during qualification.

(e) Particular care shall be given to ensure that the weld region is free of all potential sources of hydrogen. The surfaces to be welded, filler metal, and shielding gas shall be suitably controlled. After excavating the flaw (which will typically use the electrical discharge machining process) the excavation and surrounding area will be cleaned to assure they are free of dust, sediments, oxides, boric acid residue, etc.

4.0 EXAMINATION

(a) Prior to welding, a surface examination shall be performed on the area to be welded.

(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 (if practical) when the completed weld has been at ambient temperature for at least 48 hours. The ultrasonic examination, if used, shall be in accordance with Appendix I of the 1989 Edition of ASME Code, Section XI, with the 1989 Addenda and later editions and addenda.

(c) NDE personnel shall be qualified in accordance with the 1989 Edition of ASME Code, Section XI, IWA-2300.

(d) Surface examination acceptance criteria shall be in accordance with the 1989 Edition of ASME Code, Section III, NB-5340 or NB-5350, as applicable. Ultrasonic examination acceptance criteria shall be in accordance with Table IWB-3514-2 of the 1989 Edition of ASME Code, Section XI.

5.0 DOCUMENTATION

The use of this procedure to conduct repairs shall be documented on Form NIS-2.

BASIS FOR PROPOSED ALTERNATIVE

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is requested on the basis that compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Additionally, the Nuclear Regulatory Commission (NRC) has approved similar alternatives for North Anna Power Station Unit 2 and Turkey Point Unit 3. These bases are discussed in the following sections.

HARDSHIP OR UNUSUAL DIFFICULTY

Establishing and maintaining a 350°F or 300°F preheat until completion of the welding process would be difficult given the large mass and complex geometry of the vessel head and penetrations. It would be particularly difficult to establish and maintain a 450° - 550°F post-weld heat treatment on the component. Radiography of the repair weld would not be possible because of the configuration of the head and penetration attachment.

Removal of a portion of the first layer of the repair weld would be difficult, if not impossible to perform remotely. The work involved to prepare the head for pre- and post-weld heating operations, the manual SMAW process, and the removal of a portion of the first layer of the repair would all require that personnel work in close proximity to the interior surface of the reactor pressure vessel head and be subjected to significant radiation exposures. Indiana Michigan Power Company (I&M) estimates that the proposed alternative would save approximately 13 person–rem on each VHP attachment weld for which the alternative was used.

LEVEL OF QUALITY AND SAFETY

Research that has been done by the Electric Power Research Institute (EPRI) and other organizations on the use of an ambient temperature machine GTAW temper bead welding process is documented in EPRI Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temper Bead Applications," dated November 1998. The report documents that the process has been shown to be effective by research, successful procedure qualifications, and successful repairs. Three areas of concern, hydrogen induced cracking, stress relief, and toughness, are discussed below.

Hydrogen Induced Cracking

The requirements in ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500 for a 350°F or 300°F preheat, and a post-weld heat treatment at 450°F to 550°F for 4 hours for P-3 materials are typically used to mitigate the effects of the solution of atomic hydrogen in ferritic materials prone to hydrogen embrittlement cracking. The susceptibility of ferritic steels is directly related to their ability to transform to martensite with appropriate heat treatment. Although the filler metal to be used for the repairs is F-43 (ERNiCrFe-7), which is not subject to hydrogen embrittlement cracking, the P-3 base materials are known to be subject to this phenomenon to a limited extent. As described below, the ambient temperature automatic or machine GTAW temper bead process would mitigate this propensity as effectively as the processes required by ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500, without the use of elevated preheat and post-weld heating.

The ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500 temper bead procedures require the use of the SMAW welding process with covered electrodes. Even the low hydrogen electrodes which are required by ASME Code, Section XI, IWA-4500 may be a source of hydrogen unless very stringent electrode baking and storage procedures are followed. The only shielding of the molten weld puddle and surrounding metal from moisture in the atmosphere (a source of hydrogen) is the evolution of gases from the flux and the slag that forms from the flux and covers the molten weld metal. As a consequence of the possibility for contamination of the weld with hydrogen, ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500 require preheat and post-weld heat treatment to bake out the hydrogen.

The ambient temperature automatic and machine GTAW temper bead processes use a welding process that is inherently free of hydrogen. The GTAW process relies on bare welding electrodes with no flux to trap moisture. Shielding for the weld and surrounding metal is provided by an inert gas blanket which protects them from the atmosphere and the moisture it may contain and typically produces porosity free welds. In accordance with the weld procedure qualification, welding grade argon is used for the inert gas blanket. Typically, the argon would be 99.9996% pure with no more than 10 parts per million of hydrogen. A typical argon flow rate would be approximately 55 cubic feet per hour and would be adjusted to assure adequate shielding of the weld without creating a venturi affect that might draw oxygen or water vapor from the ambient atmosphere into the weld. To further reduce the likelihood of any hydrogen evolution or absorption, the ambient temperature automatic and machine GTAW temper bead processes require specific controls to ensure the weld region is free of all sources of hydrogen, as described in Paragraph 3.0(e) of the proposed alternative.

As documented in EPRI Report GC-111050, hydrogen delayed cracking generally occurs within 48 hours of completion of the weld. Given the 3/8 inch limit on repair depth in the ferritic material that is stipulated in Paragraph 1.0(c) of the proposed alternative, the 48 hour delay before final examination required by Paragraph 4.0(b) of the proposed alternative would provide ample time for any hydrogen delayed cracking to occur. Thus, in the highly unlikely event that hydrogen induced cracking did occur, it would be detected.

Stress Relief

As documented in the EPRI report, research shows that carefully controlled heat input and bead placement allow subsequent welding passes to relieve stress and temper the HAZ of the base material and preceding weld passes. The use of the ambient temperature automatic or machine GTAW temper bead process would allow more precise control of heat input, bead placement, and bead size and contour than the manual SMAW process required by ASME Code, Section III, NB-4622.9 and ASME Code, Section XI, IWA-4500. The very precise control over these factors afforded by the process provides more effective tempering and eliminates the need to grind or machine the first layer of the repair.

Toughness

Results of procedure qualification for CNP indicate that the ambient temperature automatic and machine GTAW ambient temper bead processes produce sound and tough welds. For instance, tensile test results show that breaks in the weld metal have been ductile breaks. A typical set of Charpy test values showed average absorbed energies and mils lateral expansions of 76 ft.-lbs. and 45 mils for the base metal (a P-3 Grade 3 material), 114 ft.-lbs. and 57 mils for the heat affected zone, and 254 ft.-lbs. and 84 mils for the weld metal (an F-43 filler metal). These results indicate that the GTAW ambient temper bead process produces welds equivalent to that which would be achieved by the requirements of ASME Code, Section III, NB-4622.9 or ASME Code, Section XI, IWA-4500.

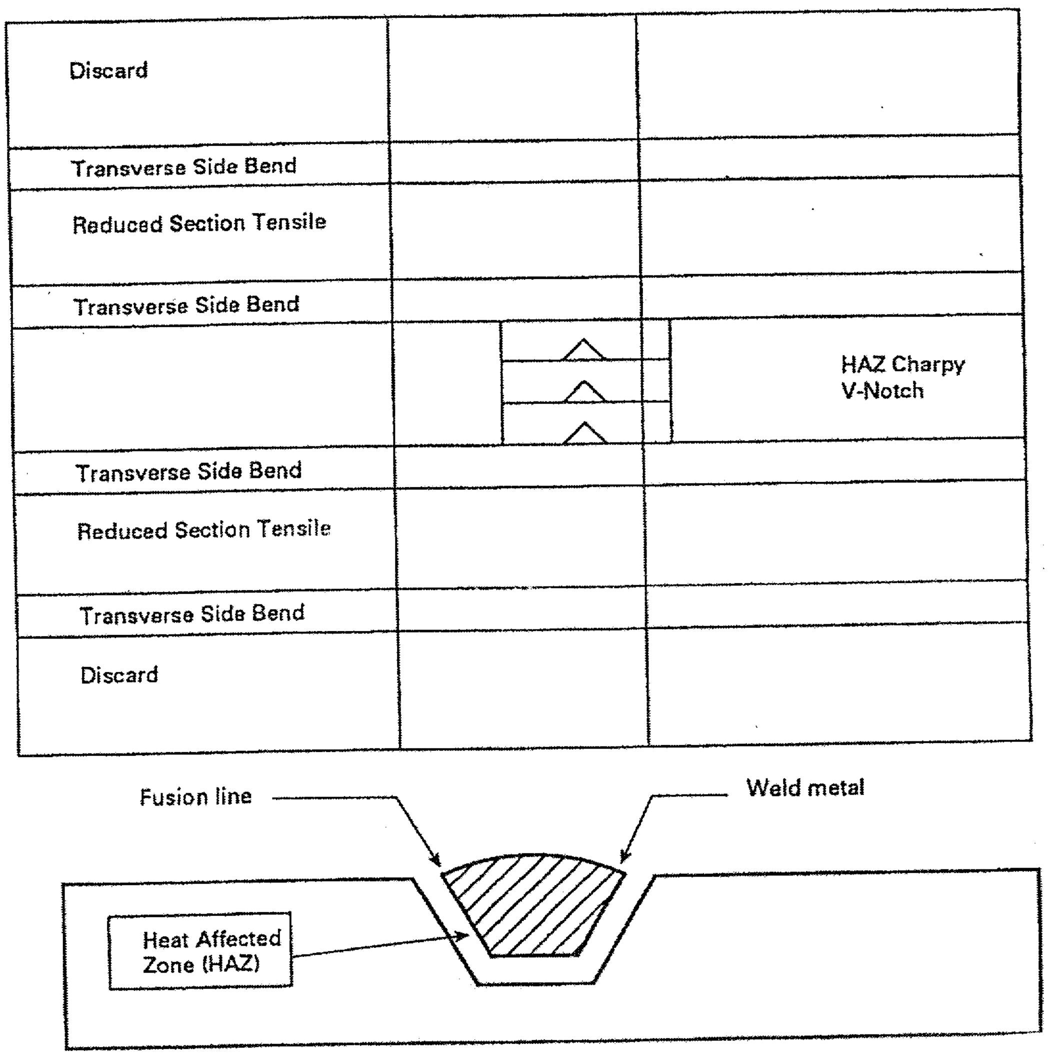
NRC APPROVAL OF SIMILAR ALTERNATIVES

I&M understands that the NRC has verbally approved a similar alternative for North Anna Power Station Unit 2 (Docket 50-339). The alternative for North Anna Power Station Unit 2 was transmitted and supplemented by Virginia Electric and Power Company letters dated October 18, November 9, and November 16, 2001.

The NRC has also approved a similar alternative for Turkey Point Unit 3 (Docket 50-250). Approval of the Turkey Point Unit 3 alternative was documented in an NRC letter dated October 5, 2001. Although the Turkey Point Unit 3 alternative was applied to a different VHP weld than the alternative proposed for CNP, both alternatives use the GTAW ambient temper bead process.

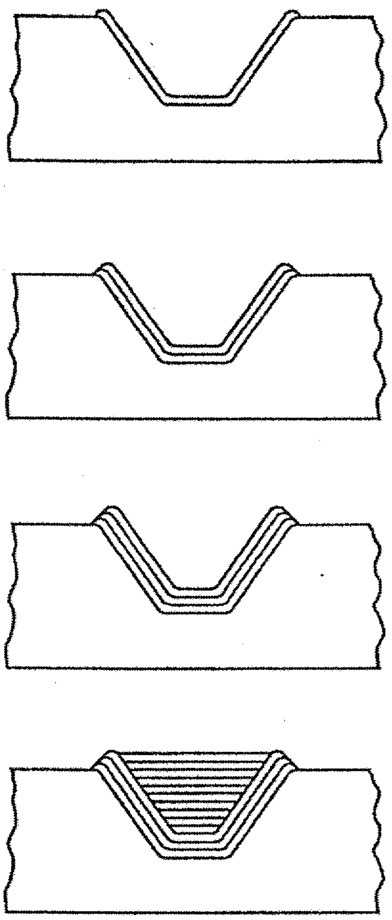
CONCLUSION

The proposed alternative to use the ambient temperature automatic or machine GTAW temper bead process will provide adequate protection against hydrogen induced cracking, and will provide adequate stress relief and toughness. Therefore, requiring the use of ASME Code, Section III, NB-4622.9 or ASME Code, Section XI, IWA-4500 rules for SMAW would impose significant hardship and unnecessary personnel radiation exposure without any compensating increase in the level of quality or safety.



GENERAL NOTE: Base metal Charpy impact specimens are not shown.

FIG. 1 QUALIFICATION TEST PLATE



Step 1: Deposit layer one with first layer weld parameters used in qualification.

Step 2: Deposit layer two with second layer weld parameters used in qualification. NOTE: Particular care shall be taken in application of the second layer at the weld toe to ensure that the weld metal and HAZ of the base metal are tempered.

Step 3: Deposit layer three with third layer weld parameters used in qualification. NOTE: Particular care shall be taken in application of the third layer at the weld toe to ensure that the weld metal and HAZ of the base metal are tempered.

Step 4: Subsequent layers to be deposited as qualified, with heat input less than or equal to that qualified in the test assembly. NOTE: Particular care shall be taken in application of the fill layers to preserve the temper of the weld metal and HAZ.

GENERAL NOTE: The illustration above is for similar-metal welding using a ferritic filler material. For dissimilar-metal welding, only the ferritic base metal is required to be welded using steps 1 through 3 of the temperbead welding technique.

FIG. 2 AUTOMATIC OR MACHINE (GTAW) TEMPERBEAD WELDING

ATTACHMENT 2 TO C1201-02

Relief Request ISI-2001-02

PROPOSED ALTERNATIVE FOR FLAW REPAIR

COMPONENT IDENTIFICATION

Code Class:	1
References:	1989 American Society of Mechanical Engineers (ASME) Code, Section III, NB-4622.9 1989 ASME Code, Section XI, IWA-4120, IWA-4500
Examination Category:	B-E
Item Numbers:	B4.12
Description:	Alternative repair techniques for reactor pressure vessel head penetration (VHP) J-groove attachment welds and the outer diameter of VHPs utilizing embedded flaw repair techniques.
Component Numbers:	1-OME-1, Donald C. Cook Nuclear Plant (CNP) Unit 1 Reactor Pressure Vessel (79 penetrations) 2-OME-1, CNP Unit 2 Reactor Pressure Vessel (78 penetrations)

CODE REQUIREMENT

CNP Units 1 and 2 are in the third ten-year inservice inspection interval using the 1989 Edition of ASME Code, Section XI.

ASME Section XI, IWA-4120, "Rules and Requirements," 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:..."

ASME Section XI, IWA-4310, "Repair Program," states:

"Defects shall be removed or reduced in size in accordance with this Article...."

Neither ASME Code, Section XI, IWA-4120 nor ASME Code, Section XI, IWA-4310 allow welding over or embedding an existing flaw.

PROPOSED ALTERNATIVE

Any flaws requiring repair that are identified on reactor VHPs and on the J-groove attachment welds will be embedded with a weld overlay which will prevent further growth of the defects by isolating them from the reactor coolant which might cause them to propagate by primary water stress corrosion cracking (PWSCC).

For an inside diameter (ID) repair, an unacceptable axial flaw will be first excavated (or partially excavated) to a depth no greater than 0.125 inches. The excavation will be performed using an electric discharge machining process to minimize penetration tube distortion. After the excavation is complete, either an ultrasonic test (UT) or eddy current test (ECT) will be performed to ensure the entire flaw length is captured. Then an Alloy 52 weldment will be applied to fill the excavation. Finally, the finished weld will be examined by dye penetrant test (PT), UT or ECT to ensure acceptability. If an unacceptable ID circumferential flaw is detected, the flaw will either be repaired in accordance with existing code requirements, or will be partially excavated to reduce the flaw to an acceptable size, examined by UT or ECT, overlaid with Alloy 52, and examined by PT, UT or ECT as described above.

Outside diameter (OD) repairs will be addressed as follows:

1. An unacceptable OD axial or circumferential flaw in a tube below a J-groove attachment weld will be sealed off with Alloy 52 weldment. Excavation or partial excavation of such flaws will not be required, since clearance is not a concern on the outside of a tube.

2. Unacceptable radial OD flaws on the J-groove attachment weld will be sealed off with a 360 degree overlay of Alloy 52 covering the entire weld. No excavation will be required.

3. Unacceptable axial tube flaws extending into the J-groove attachment weld will be sealed with Alloy 52 as in Item 1 above. In addition, the entire J-groove attachment weld will be overlaid with Alloy 52 to embed the axial crack in the seal weld on the VHP penetration.

4. Unacceptable OD circumferential flaws at or above the attachment weld will either be repaired in accordance with existing code requirements, or will be partially excavated to reduce the flaw to an acceptable size, and overlaid with Alloy 52.

5. For all of the above flaw configurations, the finished weld will be examined by PT, UT or ECT to ensure acceptability.

BASIS FOR PROPOSED ALTERNATIVE

Pursuant to 10 CFR 50.55a(a)(3)(i), the alternative is proposed on the basis that it provides an acceptable level of quality and safety.

The embedded flaw repair technique is considered a permanent repair for the following reasons:

1. As long as a PWSCC flaw remains isolated from the primary water (PW) environment, it cannot propagate. Since Alloy 52 weldment is considered highly resistant to PWSCC, a new PWSCC crack cannot initiate and grow through the Alloy 52 overlay to reconnect the PW environment with the embedded flaw. Structural integrity of the affected VHP J-groove attachment weld will be maintained by the remaining unflawed portion of the weld.

2. The residual stresses produced by the embedded flaw technique have been measured and found to be relatively low. This was documented in the attachment to a letter from E. E. Fitzpatrick, Indiana Michigan Power Company (I&M), to the Nuclear Regulatory Commission (NRC) Document Control Desk, "Reactor Vessel Head Penetration Alternate Repair Techniques," letter AEP:NRC:1218A, dated March 12, 1996. The low residual stresses indicate that no new cracks will initiate and grow in the area adjacent to the repair weld.

3. There are no other known mechanisms for significant crack propagation in this region since cyclic fatigue loading is negligible.

I&M understands that the NRC has verbally approved a similar alternative for North Anna Power Station Unit 2 (Docket 50-339). The alternative for North Anna Power Station Unit 2 was transmitted and supplemented by Virginia Electric and Power Company letters dated October 18, November 9, and November 16, 2001. Additionally, the NRC previously approved a similar alternative for CNP Units 1 and 2. The approval was documented in an NRC letter dated April 9, 1996. Although the alternative was applied to the VHP tube base metal rather than VHP welds, both alternatives use an embedded flaw repair technique.

CONCLUSION

I&M considers the embedded flaw repair technique to be an alternative to Code requirements that provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).