Niagara Mohawk®

Richard B. Abbott
Vice President
Nuclear Engineering

Phone: 315.349.1812
Fax: 315.349.4417

March 7, 2000
NMP2L 1942

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

RE: Nine Mile Point Unit 2
Docket No. 50-410
NPF-69

Subject: *Proposed Alternative for the Contingency Repair of Certain Reactor Pressure Vessel Nozzles per Generic Letter 88-01*

Gentlemen:

The purpose of this letter is to request approval of a repair plan per the requirements of Generic Letter 88-01 for certain reactor pressure vessel (RPV) nozzles to safe end welds as an alternative to 10CFR50.55a(c)(3)(iv). The repair plan uses modified weld overlays that represent an alternative to "American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code," Section XI Code repair.

Weldments associated with the recirculation system and feedwater system RPV nozzle to safe end welds are being inspected during the Nine Mile Point Unit 2 (NMP2) seventh refueling outage (RFO7) to satisfy the requirements of Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping." A previous inspection of several of these nozzles has identified indication(s) in the nozzles. Based on an evaluation of these indications, Niagara Mohawk Power Corporation (NMPC) has concluded that the likelihood of the inspection results from RFO7 necessitating the repair of at least one of these nozzles to safe end welds is relatively high. Therefore, NMPC has developed a contingency repair plan, which would support repair of RPV nozzle(s) to safe end weld(s) containing unacceptable indication(s) in the weldment(s).

The repair plan includes use of ASME Code Cases N-638, 2142-1, 2143-1 and partial use of Code Case N-504-1, in that exceptions are taken from Code Case N-504-1. These four Code Cases have been approved by the American Society of Mechanical Engineers (ASME) and, additionally, Code Case N-504-1 has been approved by the Nuclear Regulatory Commission (NRC) in Regulatory Guide 1.147. Exceptions from Code Case N-504-1, which are similar to NMPC's request contained in the Attachment, have been approved by the Staff for the Duane Arnold Energy Center, as presented in the Staff's letter dated November 19, 1999. The repair plan presented by NMPC in the Attachment is an alternative to the requirements of 10CFR50.55a(c)(3)(iv).

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Based on the evaluations contained in the Attachment, NMPC has concluded that this alternative provides an acceptable level of quality and safety and that strict adherence to the specified requirements would result in unusual difficulty without a compensating increase in the level of quality and safety. Therefore, this proposed contingency alternative satisfies the requirements of 10CFR50.55a(a)(3)(i) and 10CFR50.55a(a)(3)(ii).

Review and approval of the proposed contingency repair alternative is requested by March 10, 2000, which is the earliest date on which NMPC would commence repair activities in the event an unacceptable indication is confirmed during the examination of these welds.

Sincerely,

Richard B. Abbott
Vice President Nuclear Engineering

RBA/SHC/tmk
Attachment

cc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Ms. M. K. Gamberoni, Acting Section Chief PD-I, Section 1, NRR
Mr. G. K. Hunegs, NRC Senior Resident Inspector, NMP
Mr. P. S. Tam, Senior Project Manager, NRR
Records Management

ATTACHMENT

Proposed Alternative for Contingency Weld Overlay Repair of Feedwater and Recirculation System Nozzle To Safe End Weldments on the Reactor Pressure Vessel Nozzles (RR-IWB-15)

A. COMPONENT IDENTIFICATION

A full structural weld overlay repair is proposed for the recirculation system (RCS) inlet and feedwater nozzles. The current configuration of these nozzles is described below.

The N2 recirculation inlet nozzle to safe-end configuration consists of Type 316L safe-end welded to a SA 508 Cl. 2 nozzle. The ends of both the safe-end and the nozzle were buttered with Alloy 182 weld deposit and welded with nickel based Alloy 82.

The feedwater nozzle to safe-end consists of an ASME SA508 Cl. 1 safe-end welded to a SA 508 Cl. 2 nozzle. The ends of both the safe-end and the nozzle are buttered with Alloy 182 weld deposit and subsequently joined using Alloy 82.

B. EXAMINATION AND REPAIR REQUIREMENTS

Weld overlays will be designed consistent with the requirements of NUREG-0313, Revision 2 (which was implemented by Generic Letter 88-01), ASME Code Case N-504-1, and ASME, Section XI, Paragraph IWB-3640, 1989 Edition with Appendix H (1989 Addenda).

Welder Qualification and Welding Procedures

All welders and welding procedures will be qualified in accordance with ASME Section IX and any special requirements from Section XI or applicable code cases. A manual shielded metal arc weld (SMAW) procedure will be qualified to facilitate localized repairs and to provide a seal weld, prior to depositing the overlay, should the defect be near through-wall or through-wall and leaking. This procedure will make use of UNS W86152 SMAW electrodes consistent with the requirements of ASME Section IX, Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode." The repair activities will be performed by qualified personnel from Welding Services Incorporated (WSI) and shall be in accordance with WSI's Nuclear Repair (NR) Certificate of Authorization. The repairs will be performed in accordance with WSI Welding Procedure Specification (WPS 01-43-T-802, Rev. 0) for welding Alloy 52.

Welding Wire Material

A consumable welding wire highly resistant to intergranular stress corrosion cracking (IGSCC) was selected for the overlay material. This material, designated UNS N06052 is a nickel-based weld filler material, commonly referred to as Alloy 52, and will be applied using the gas tungsten arc welding (GTAW) process. Alloy 52 is identified in Code Case 2142-1 as F-No. 43 Grouping for Ni-Cr-Fe, classification UNS N06052 Filler Metal. Alloy 52 contains about 30% chromium that imparts excellent corrosion resistance to this material.

Weld Overlay Design

The weld overlay will extend around the full circumference of each of the safe end to nozzle locations in accordance with NUREG-0313, Revision 2, Code Case N-504-1 and Generic Letter 88-01. The overlay length will extend symmetrically across the projected indication intersection(s) with the outer pipe surface. The specific thickness and length will be computed according to guidance provided in ASME Section XI, Code Case N-504-1 and ASME Section XI, Paragraph IWB-3640, 1989 Edition with Appendix H (1989 Addenda). The overlay will completely cover the indication locations and the Alloy 182 weld deposit with the highly corrosion resistant Alloy 52 material. In order to accomplish this objective, it will be necessary to weld on the low alloy steel (LAS) nozzle material. A temper bead welding approach will be used for this purpose according to provisions of recently approved ASME Code Case N-638. This code case provides for machine gas tungsten-arc welding (GTAW) temper bead weld repairs to P No. 3 nozzle materials (SA 508 Cl. 2) at ambient temperature. The temper bead approach was selected because temper bead welding supplants the requirement for post weld heat treatment (PWHT) of heat affected zones in welded LAS material. Also, temper bead welding techniques produce excellent toughness and ductility in heat affected zones of welded LAS materials.

The weld overlay length will conform to the guidance in Code Case N-504-1, which satisfies the stress requirements of the Code Case.

Examination Requirements

The examination of the weld overlay repairs will satisfy the evaluation requirements summarized in the following table.

Examination Description	Method	Technique	Reference
Thickness Measurements	UT	0° Long.	Repair Plan
As-Found Exam	Auto UT	45° Ref. Long. 60° Ref. Long. 70° Ref. Long.	IWB-3514
As-Found Sizing	Auto UT	60° Ref. Long. 70° Ref. Long.	IWB-3514
Weld and Safe-End Overlay Surface Preparation Exam	PT	Visible Dye	N-504-1
First Weld Overlay Thickness Checks	UT	0° Long, or Hand Meas.	Repair Plan
First Weld Overlay Layer Surface Exam	PT	Visible Dye	N-504-1
Exam of Completed Overlay for Lack-of-Bond and Thickness	UT	0° Long.	Repair Plan IWB-3514 N-504-1
Surface Exam of Completed Overlay	PT	Visible Dye	N-504-1
Volumetric Exam of Completed Overlay	UT	60° Ref. Long.	IWB-3514 N-504-1
Pre-Service Exam of Completed Overlay and the Outer 25% of the underlying pipe wall to identify the original flaws.	UT	60° Ref. Long. OD Creeping Wave	N-504-1 IWB-3514

General Note: The Edition and Addenda for the ASME Section XI acceptance criteria is the 1989 Edition with no Addenda. The weld overlay examinations comply with the recommendations of NUREG-0313, Revision 2, and also with Code Case N-504-1.

Following the repair, a system leakage test will be performed in accordance with ASME, Section XI, Code Case N-504-1 or Code Case N-416-1, approved in NRC Regulatory Guide 1.147, as applicable.

Unusual Difficulty in Meeting Specified Requirements

Preheat and post weld heat treatments (PWHT) are required for welding on P3 LAS nozzle material by ASME Section III, Subparagraph NB4622.7. These requirements are highly impractical without draining the reactor vessel, and may distort the P3 components involved. To drain the vessel requires a full-core offload of the fuel. And if the vessel were drained, the radiation dose rates in the nozzle area would increase significantly, resulting in additional personnel exposure. Therefore, consistent with ALARA practices and prudent utilization of outage personnel there will be no vessel drain down for this repair. The weld overlays will be completed with water on the inside surface of the nozzles and connected piping. This approach (i.e., no vessel drain down) minimizes fuel movement and thereby enhances nuclear safety.

The alternative, as described below, provides an acceptable level of quality and safety while neither draining the reactor vessel nor applying preheat and post weld heat treatments. Therefore, the alternative alleviates the impracticality of following certain code requirements for this repair activity.

C. ALTERNATIVE FROM REPAIR REQUIREMENTS

The repair will utilize ASME Code Case N-504-1, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," and Code Case N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," with the following exceptions and clarifications.

Clarification of Code Case N-504-1 for Applicability to Nickel-Based Austenitic Steel

Code Case N-504-1 was prepared specifically for austenitic stainless steel material. An alternate application to nickel-based austenitic materials (i.e., Alloy 52) is requested due to the specific configuration of the nickel-based austenitic weldment.

Exception from Code Case N-504-1 Paragraph (b)

Code Case N-504-1 paragraph (b) requires that the reinforcement weld metal shall be low carbon (0.035 % maximum) austenitic stainless steel. A nickel-based filler is required and Alloy 52 has been selected in place of low carbon austenitic stainless steel.

Exception from Code Case N-504-1 Paragraph (e)

Code Case N-504-1 paragraph (e) requires as-deposited delta ferrite measurements at least 7.5 for the weld reinforcement. These measurements are not to be performed for this overlay.

Clarification of Code Case N-638 Applicability

Code Case N-638 shall be applied to the P3 LAS nozzle material.

Use of Code Case 2142-1

Code Case 2142-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS N06052 Filler Metal," will be used.

Use of Code Case 2143-1

Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode," may be used to make localized repairs.

D. BASIS FOR THE ALTERNATIVE

Clarification of Code Case N-504-1 for Applicability to Nickel-Based Austenitic Steel

The weldment being addressed is austenitic material having a mechanical behavior similar to austenitic stainless steel. Accordingly, this alternative provides an acceptable level of quality and safety. Therefore, Code Case N-504-1 should be interpreted to apply equally to both materials.

Exception from Code Case N-504-1 Paragraph (b)

A consumable welding wire highly resistant to IGSCC was selected for the overlay material. This material, designated UNS N06052 is a nickel-based alloy weld filler material, commonly referred to as Alloy 52, and will be applied using the gas tungsten arc welding (GTAW) process. Alloy 52 contains about 30% chromium that imparts excellent corrosion resistance to this material. By comparison, Alloy 82, is identified as an IGSCC resistant material in NUREG 0313 Revision 2 and contains about 18 to 22% chromium while Alloy 182 has a nominal chromium composition of 13 to 17%.

Exception from Code Case N-504-1 Paragraph (e)

The composition of nickel-based Alloy 52 is such that delta ferrite is not formed during welding. Ferrite measurement requirements were developed for welds of 300 series stainless steel that require delta ferrite to develop corrosion resistance. Welds of Alloy 52 and Alloy 152 are 100% austenitic and contain no delta ferrite due to the high nickel composition (approximately 60% Ni).

Clarification of Code Case N-638 Applicability

Code Case N-638 was developed for temper bead applications to similar and dissimilar metals. It permits the use of machine gas tungsten arc welding (GTAW) at ambient temperature without the use of preheat or PWHT on Class 1, 2, and 3 components.

Temper bead welding methodology is not new. Numerous applications over the past decade have demonstrated the acceptability of temperbead technology in nuclear environments. Temperbead welding achieves heat affected zone (HAZ) tempering and grain refinement without subsequent post weld heat treatment (PWHT). Excellent HAZ toughness and ductility are produced.

A 48-hour post weld hold prior to acceptance inspection is required by Code Case N-638 and will be done to assure that no delayed cracking occurs.

Use of Code Case 2142-1

Code Case 2142-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS N06052 Filler Metal," will be used. The composition of these alloys produces a material that possesses excellent resistance to IGSCC mechanisms. Because the chromium content is nominally 30% the corrosion resistance will be superior to any of the materials to which it is being applied. In addition, the material is compatible for welding on any of the substrate materials.

Use of Code Case 2143-1

Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode," will be used. The composition of these alloys produces a material that possesses excellent resistance to IGSCC mechanisms. Because the chromium content is nominally 30%, the corrosion resistance will be superior to any of the materials to which it is being applied. In addition, the material is compatible for welding on any of the substrate materials.

E. CONCLUSION

Weld overlays involve the application of weld metal circumferentially around the pipe in the vicinity of the flawed weld to restore ASME Section XI margins as required by ASME Code Case N-504-1. Weld overlays have been used in the nuclear industry as an acceptable method to repair flawed welds. The use of overlay filler material that provides excellent resistance to IGSCC develops an effective barrier to crack extension by corrosion processes.

The piping and other components have been evaluated (to the original ASME design code requirements) for the effects due to shrinkage induced into the system during the installation of the overlay. The actual shrinkage will be measured. All required documents will be reconciled to the original design code, and updated to reflect these as-built values.

The design of the overlays for the nozzle safe ends uses methods that are standard in the industry for size determination of pipe-to-pipe overlays. There are no new or different approaches used in these overlay designs which are considered first of a kind or inconsistent with previous approaches. The overlay is designed as a full structural overlay in accordance with the recommendation of NUREG-0313, Revision 2, which was forwarded by Generic Letter 88-01 and by Code Case N-504-1 and ASME Section XI Paragraph IWB-3640, 1989 Edition with Appendix H (1989 Addenda).

Temper bead techniques, as defined by Code Case N638, will produce the tough corrosion resistant overlay deposit that meets or exceeds all code requirements for the weld overlay.

Niagara Mohawk Power Corporation concludes that the contingency repair plan is justified and presents an acceptable level of quality and safety to satisfy the requirements of 10CFR50.55a(a)(3)(i). Furthermore, this evaluation demonstrates that compliance with the 1989 edition of ASME Section XI with no addenda (the current Code of record for Nine Mile Point Unit 2) would result in unusual difficulty without a compensating increase in the level of quality and safety pursuant to 10CFR50.55a(a)(3)(ii).

A similar proposed alternative from the requirements of 10CFR50.55a(c)(3)(iv) has been previously approved by the NRC for the Duane Arnold Energy Center by Staff letter dated November 19, 1999.