

March 30, 2000

Mr. John H. Mueller  
Chief Nuclear Officer  
Niagara Mohawk Power Corporation  
Nine Mile Point Nuclear Station  
Operations Building, Second Floor  
P.O. Box 63  
Lycoming, NY 13093

SUBJECT: NINE MILE POINT NUCLEAR STATION, UNIT NO. 2 (NMP2) -- ALTERNATIVE TO AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE (ASME CODE) REQUIREMENTS FOR REPAIR OF RECIRCULATION AND FEEDWATER NOZZLE TO SAFE-END WELDS AT NMP2 (TAC NO. MA8352)

Dear Mr. Mueller:

By letter dated March 7, 2000, you proposed an alternative to the ASME Code, Section XI repair requirements. The proposed alternative consists of the use of Code Cases N-504-1, "Alternative Rules for Repair of Class 1, 2, 3 Austenitic Stainless Steel Piping," and N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW [Gas Tungsten Arc Welding] Temper Bead Technique," with modifications to perform weld overlay repairs of flawed nozzle to safe-end welds in recirculation and feedwater system piping at NMP2, if needed.

During refueling outage 7, the nozzle to safe-end welds in the recirculation and feedwater piping systems are being inspected for intergranular stress corrosion cracking in accordance with Generic Letter 88-01. The proposed alternative is a contingency repair plan to be used if an unacceptable flaw in the referenced nozzle to safe-ends welds is found by ultrasonic examination.

We have reviewed your submittal and have determined that the proposed alternative to use Code Cases N-504-1 and N-638 with modifications for the weld overlay repair of the flawed recirculation and feedwater nozzle to safe-end welds is acceptable. The alternative will provide reasonable assurance of structural integrity based on maintaining the applicable code safety margins. Details of our review are set forth in the enclosed safety evaluation.

We conclude that your proposed alternative will result in an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the use of Code Case N-504-1 and N-638 with modifications as identified in your March 7, 2000, submittal to perform weld overlay repair of any flawed recirculation and feedwater nozzle to safe-end welds requiring repair at NMP2 is authorized.

J. Mueller

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This completes all our actions on your March 7, 2000, submittal. Please contact the project manager, Mr. Peter Tam (301-415-1451, electronic mail at [pst@nrc.gov](mailto:pst@nrc.gov)) if you have any questions.

Sincerely,

**/RA original signed by E.Adensam for/**

Marsha Gamberoni, Acting Chief, Section 1  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-410

Enclosure: Safety Evaluation

cc w/encl: See next page

J. Mueller

- 2 -

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Marsha Gamberoni, Acting Chief, Section 1  
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cc w/encl: See next page

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\*Safety evaluation transmitted by memo of 3/29/00 essentially used as-is.

#E. Adensam signed and concurred for M. Gamberoni.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
ALTERNATIVE TO AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND  
PRESSURE VESSEL CODE (ASME CODE) SECTION XI CODE REPAIR REQUIREMENTS  
FOR REPAIR OF RECIRCULATION AND FEEDWATER NOZZLE TO SAFE-END WELDS  
NIAGARA MOHAWK POWER CORPORATION  
NINE MILE POINT NUCLEAR STATION UNIT NO. 2  
DOCKET NO. 50-410

1.0 INTRODUCTION

By letter dated March 7, 2000, Niagara Mohawk Power Corporation (the licensee, NMPC) proposed an alternative to the ASME Code, Section XI repair requirements. The proposed alternative consists of the use of Code Cases N-504-1, "Alternative Rules for Repair of Class 1, 2, 3 Austenitic Stainless Steel Piping," and N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW [gas tungsten arc welding] Temper Bead Technique," with modifications to perform weld overlay repairs of flawed nozzle to safe-end welds in recirculation and feedwater system piping at Nine Mile Point, Unit 2 (NMP2), if needed.

During the current refueling outage 7 (RFO7), the nozzle to safe-end welds in the recirculation and feedwater piping systems are being inspected for intergranular stress corrosion cracking (IGSCC) in accordance with Generic Letter 88-01. NMPC indicated that the referenced nozzle to safe-end welds are made of nickel-based Alloy 82 material and are buttered with Alloy 182 at both ends of the welds. In addition to laboratory testing, industry-wide experience has shown that Alloy 182 is susceptible to IGSCC since cracking was found in those welds buttered with Alloy 182 at a number of operating boiling-water reactors. The proposed alternative is a contingency repair plan to be used if an unacceptable flaw in the referenced nozzle to safe-end welds is found by ultrasonic examination.

Pursuant to 10 CFR 50.55a(a)(3), proposed alternatives to the requirements of 10 CFR 50.55a(g) may be used when authorized by the NRC. NMPC must demonstrate that (1) the proposed alternative would provide an acceptable level of quality and safety (10 CFR 50.55a(a)(3)(i)), or (2) compliance with the requirements of 10 CFR 50.55a(g) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety (10 CFR 50.55a(a)(3)(ii)).

Enclosure

## 2.0 EVALUATION

### 2.1 ASME Section XI Code Repair Requirement

The current applicable ASME Section XI Code to NMP2, is the 1989 edition. Article IWB-4000, "Repair Procedures," of the subject Section XI Code Edition provides rules and requirements for repair of the pressure retaining boundary for Class 1 components and their supports. To perform a Code repair, Sub-article IWB-4120 "Procedure" requires that defects shall be removed from the degraded components prior to performing a repair by welding.

### 2.2 Proposed Alternative

NMPC proposed to use a combination of the requirements from ASME Code Cases N-504-1 with modifications for austenitic weld overlay and N-638 for ambient temperature temper bead welding technique as an alternative to the ASME Code, Section XI, IWB-4000 requirements for repair to perform weld overlay repairs on the flawed recirculation and feedwater nozzle to safe-end welds at NMP2.

### 2.3 Licensee's Bases for the Proposed Alternative

NMPC's bases for the proposed alternative are summarized below:

- (1) It is impractical to perform the Code repair, which requires the removal of the defect from the degraded component as the defect is connected to the inner diameter surface of the component. Therefore, it is necessary to use the Code Cases N-504-1 and N-638 for weld overlay repair of the degraded recirculation and feedwater nozzle to safe-end welds.
- (2) The weld overlay will be made of nickel-based Alloy 52 (ASME Code Case 2142-1) or Alloy 152 (ASME Code Case 2143-1) instead of austenitic stainless steel material as specified in Code Case N-504-1. The materials specified in Code Case N-504-1 are intended for stainless steel components and weldments. Since the referenced nozzle to safe-end welds and weld butter are made of an austenitic nickel-based Alloy 82 and 182, respectively, a nickel-based filler material of Alloy 52 or Alloy 152 will be used in weld overlay repair. Alloy 52 or 152 is resistant to IGSCC and is compatible with the existing Alloy 82 or 182 in the weld.
- (3) The overlay is designed as a full structural overlay in accordance with the ASME Code Case N-504-1 and the guidelines in NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," to assure the structural integrity of the repaired components. The overlay design assumes the subject nozzle welds to be completely cracked and will restore the Code safety margins in the overlay repairs. The overlay will cover the subject weld and portion of the nozzle adjacent to the weld.
- (4) The ambient temperature temper bead welding technique prescribed in Code Case N-638 is needed to fabricate the weld overlay on the pressure vessel

nozzle made of low alloy carbon steel to avoid embrittlement of the low alloy carbon steel without the need of preheat and post-weld heat treatment. NMPC stated that it is not practical to perform preheat and post-weld heat treatment without the draining of the vessel and the removal of the fuel. The draining of the vessel would result in significant increase of the radiation level and personnel radiation exposure, which is contrary to the ALARA principle.

## 2.4 Staff Evaluation

NMPC-proposed alternative to ASME Section XI Code repair is based on the use of Code Cases N-504-1 and N-638 with modifications to perform weld overlay repair on the subject recirculation and feedwater nozzle to safe-end welds when unacceptable defects are found during the current refuel outage (RFO7). The NRC staff notes that Code Case N-504-1 has been approved by NRC and incorporated in Regulatory Guide (RG) 1.147, "In-service Inspection Code Case Acceptability, ASME Section XI, Division 1-- for Generic Use." NMPC's proposed alternative extends the application of Code Case N-504-1 for welding P-43 materials (austenitic nickel-based alloys) on P-3 materials (low alloy carbon steel) rather than P-8 (stainless steel) materials. This is technically acceptable as long as the overlay design is based on the allowable stress limits for P-43 materials and the qualified welding procedures and personnel are used in welding fabrication. Such extended application of Code Case N-504-1 was approved by the NRC on April 29, 1999, for a similar weld overlay repair performed on a feedwater nozzle to safe-end weld at the Perry Nuclear Power Plant.

Code Case N-638 has not yet been approved by the NRC for incorporation in RG 1.147. However, the NRC staff has reviewed the supporting data for Code Case N-638. Code Case N-638 allows the use of the machine GTAW at ambient temperature without the use of preheat or postweld heat treatment on Class 1, 2, and 3 components. The staff notes that the temper bead technique prescribed in Code Case N-638 is similar to that in Code Case N-606. In Code Case N-606 the application of the temper bead technique at ambient temperature is limited to boiling-water reactor control rod drive housing or stub tube and, in Code Case N-638, the allowable application is extended to all Class 1, 2, and 3 components. Code Case N-606 has been reviewed by the NRC staff and is scheduled to be incorporated into the next edition of RG 1.147. The NRC staff had approved the use of temper bead technique at ambient temperature for overlay weld repair of recirculation nozzle to safe-end welds at Duane Arnold Plant on November 19, 1999.

The NRC staff has reviewed NMPC's submittal and has determined that the proposed alternative, to use Code Cases N-504-1 and N-638 with modifications for the weld overlay repair of the flawed recirculation and feedwater nozzle to safe-end welds at NMP2, is acceptable. This is because it will provide reasonable assurance that overlay repairs of any unacceptable flaw will restore the structural integrity thereby maintaining the applicable code safety margins.

## 3.0 CONCLUSION

Based on a review of NMPC's submittal, the NRC staff concludes that NMPC's proposed alternative will result in an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the licensee's proposed use of Code Case N-504-1 and N-638 with modifications as identified in the licensee's submittal to perform weld overlay repair of the flawed recirculation and feedwater nozzle to safe-end welds at NMP2.

Principal Contributor: William Koo

Date: March 30, 2000