



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 6, 2011

Mr. Peter Wells
Vice President
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER – RELIEF REQUEST NDE-R014
AUTHORIZED FOR WELD OVERLAY REPAIR (TAC NO. ME4984)

Dear Mr. Wells:

By letter dated November 6, 2010, and superseded by letter dated November 10, 2010, you requested relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirements at Duane Arnold Energy Center (DAEC). As an alternative to the ASME Code requirements, you proposed to implement a weld overlay repair in accordance with the requirements of ASME Code Case N-504-4, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," as modified by your November 10, 2010, letter.

Based on the review set forth in the enclosed safety evaluation, the Nuclear Regulatory Commission (NRC) staff concludes that the alternative proposed as Relief Request NDE-R014 to perform a weld overlay repair on components RRA-F002A and RRA-J003 would provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes Relief Request NDE-R014 for the installation of a weld overlay repair on components RRA-F002A and RRA-J003. This authorized alternative identified as Relief Request NDE-R014 is applicable to the fourth 10-year inservice inspection interval, which began November 1, 2006, and will end February 21, 2014.

This closes the NRC staff's action on the above submittals. If you have any questions, please feel free to contact the project manager Mr. Karl Feintuch.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Pascarelli", is positioned above the typed name.

Robert Pascarelli, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure: Safety Evaluation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION PROGRAM RELIEF REQUEST NDE-R014

DUANE ARNOLD ENERGY CENTER

NEXTERA ENERGY DUANE ARNOLD, LLC

DOCKET NUMBER 50-331

1.0 INTRODUCTION

By letter dated November 6, 2010, and superseded by letter dated November 10, 2010 (Accession Nos. ML103120111 and ML103160155, respectively), NextEra Energy Duane Arnold, LLC (the licensee), requested relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirements at Duane Arnold Energy Center (DAEC). As an alternative to the ASME Code requirements, the licensee proposed to implement a weld overlay (WOL) repair in accordance with the requirements of ASME Code Case N-504-4, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," as modified by the licensee's November 10, 2010, letter. The alternatives proposed in Relief Request NDE-R014 would permit the use of a full structural weld overlay repair for an indication identified in the N2A Recirculation Inlet Safe End to Safe End Extension Dissimilar Metal Weld (RRA-F002A) at DAEC. The Nuclear Regulatory Commission (NRC) staff verbally authorized the licensee's requested alternative in a teleconference on November 15, 2010 (Accession No. ML110240122).

This safety evaluation documents the basis of the NRC staff's verbal authorization.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The code of record for the current fourth DAEC ISI interval is the 2001 Edition with 2003 Addenda of the ASME Code, Section XI.

Pursuant to 10 CFR 50.55a(a)(3) alternatives to requirements may be authorized by the NRC if the licensee demonstrates that: (i) the proposed alternatives provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or

unusual difficulty without a compensating increase in the level of quality and safety. The licensee submitted the subject relief request, pursuant to 10 CFR 50.55a(a)(3)(i), which proposed an alternative to the implementation of the ASME Code, Section XI requirements based on ASME Code Case N-504-4 as modified by the licensee for the deposition of a WOL for the remaining service life of the identified component. Regulatory Guide (RG) 1.147, Revision 16, "Inservice Inspection Code Case Acceptability, ASME Code, Section XI, Division 1," lists the code cases that are acceptable to the NRC for application in licensees' ASME Code, Section XI ISI programs. A licensee may use a code case specified in the RG without prior approval by the NRC if it meets the conditions specified for the code case in the RG.

3.0 TECHNICAL EVALUATION

The licensee's Relief Request NDE-R014 covers the following components: RRA-F002A Recirculation Inlet Safe-End to Safe End Extension Weld, and RRA-J003 Recirculation Safe End Extension to Pipe Weld.

3.1 ASME Code Requirements

The applicable Code requirement for which relief is requested is ASME Code Section XI, 2001 Edition including Addenda through 2003, IWA-4410 and IWA-4611.

ASME Section XI, IWA-4410 states in part the following: "Welding, brazing, defect removal, metal removal by thermal methods and installation shall be performed in accordance with the requirements of this Subarticle."

ASME Section XI, IWA-4611(a) states in part the following: "Defects shall be removed in accordance with IWA-4422.1."

3.2 Licensee's Proposed Alternatives and Basis

3.2.1 Reason for the Proposed Alternative

Section 4.0 of the licensee's November 10, 2010, letter provides the reason for the need for the proposed alternative:

Dissimilar metal welds (DMWs), primarily consisting of Alloy 82/182 weld metal are frequently used in boiling water reactor (BWR) construction to connect stainless or Inconel safe ends to vessel and pipe nozzles, generally constructed of carbon or low alloy ferritic steel. These welds have shown a propensity for intergranular stress corrosion cracking (IGSCC) degradation in [b]oiling [w]ater [r]eactor (BWR) environments.

This request is based on restoring the structural integrity of the RRA-F002A weld joint using technically sound welding practices and non-destructive examination (NDE), while limiting repair personnel exposure to the maximum extent practical. The following cited Code article identifies the actions that would be required if the repair were conducted in accordance with the Code without exception.

IWA-4421(a) requires defect removal in this case. The repair cavity would extend through wall since outer diameter (OD) removal would be required. Internal diameter (ID) removal of the indication would be impractical since it would require the removal of the thermal sleeve and jet pump riser from the reactor interior.

3.2.2 The Licensee's Proposed Alternative

Section 5.0 of the licensee's November 10, 2010, letter provides the licensee's proposed alternative:

A full structural weld overlay repair is proposed for the safe-end-to-safe-end-extension weldment. The safe-end is Alloy 600 SB-166 austenitic nickel base Inconel forging (ASME Section II SB-166). The safe-end-extension is SA-336 Class F8 austenitic stainless steel forging (304 stainless steel). The full structural weld overlay will be extended beyond the safe end extension to stainless steel pipe weld to allow for ultrasonic examination of both of the welds, see Figure 1.

The weld overlay will be designed consistent with the requirements of NUREG-0313, Revision 2 (which was implemented by Generic Letter (GL) 88-01), the requirements specified in Attachment 1, and IWB-3640, ASME Section XI 2001 Edition, including Addenda through 2003 with Appendix C.

This proposed alternative (Attachment 1) is the result of industry's experience with weld overlay modifications for flaws suspected or confirmed to be caused by stress corrosion cracking and directly applies Alloy 52 or 52M weld material that is primarily being used for these weld overlays.

The ultrasonic examination of the completed overlay will be accomplished with personnel and procedures qualified in accordance with ASME Code, Section XI, 2001 Edition, for Appendix VIII, Supplement 11 (as approved by the NRC in Relief Request NDE-R002 (ML070090357)).

3.2.3 The Licensee's Technical Basis for the Proposed Alternative

The licensee's technical basis may be found on pages 2 – 5 of the relief request. On those pages the licensee addressed the issues of structural weld overlay design, welding, and examination, precedents, and duration of the proposed alternative.

3.3 NRC Staff Evaluation

3.3.1 General Requirements

Under the rules of ASME Code, Section XI, IWA-4421, repairs shall be performed in accordance with the owner's requirements and the original construction code. Later editions and addenda of the construction code or of ASME Code, Section III, either in their entirety or portions thereof, and ASME code cases may be used. Regulatory Guide (RG) 1.147, Revision 16, "Inservice Inspection code case Acceptability, ASME Code, Section XI, Division 1," lists the code cases that are acceptable to the NRC for application in licensees' ASME Code, Section XI ISI programs. A licensee may use a code case specified in RG 1.147 without prior approval by the

NRC if it meets the conditions specified for the code case. Revision 16 of RG 1.147 allows the use of ASME Code Case N-504-4 with a condition. This condition requires the use of Nonmandatory ASME Code, Section XI, Appendix Q in addition to the nondestructive examination requirements of ASME Code Case N-504-4 and ASME Code, Section XI.

The NRC staff notes that the licensee's use of Alloy 52M material is consistent with weld materials used to perform similar WOLs at other operating boiling water reactor facilities. The NRC staff also notes that the licensee is performing the subject WOL on welds made of Alloy 82/182 and austenitic stainless steel materials. For material compatibility in welding, the NRC staff considers that Alloy 52M is a better choice of filler material than the Alloy 82/182 or austenitic stainless steel material for this weld joint configuration. Alloy 52M contains about 30 percent chromium, which provides excellent resistance to stress corrosion cracking if exposed to the reactor coolant environment. This material is identified as F-No. 43 filler metal and has been previously approved by the NRC staff for similar applications. As for the potential for hot cracking, the NRC staff agrees that the use of an ER308L buffer layer on all stainless steel when depositing an overlay with Alloy 52M filler metal can lessen hot cracking concerns. Therefore, the licensee's proposed use of Alloy 52M for the WOL as a modification to the requirements of Code Case N-504-4, and ASME Code Section XI, Appendix Q, is acceptable as it will provide an acceptable level of quality and safety.

3.3.2 Nondestructive Examination

ASME Code Case N-504-4 and ASME Code, Section XI, Appendix Q address austenitic stainless steels and they do not specifically apply to the welding in question since the welding involves a full structural overlay over welds (identified as RRA-F002A Recirculation Inlet Safe-End-to-Safe-End Extension Weld and RRA-J003 Recirculation Safe End Extension-to-Pipe Weld, which are fabricated from P-No. 8-to-P-No. 43 and P-No. 8-to-P-No. 8 materials, respectively). The overlay will be applied with an F-No. 43 filler metal (high nickel alloy filler metal), specifically, Alloy 52M. The licensee will be meeting the nondestructive examination requirements of ASME Code Case N-504-4, ASME Code, Section XI, Appendix Q and ASME Code, Section XI, as they apply to using an Alloy 52M filler metal. The nondestructive examination to be performed is based on the latest industry experience and consistent with the current practice for the repairs to be performed and, therefore, is acceptable as it will provide an acceptable level of quality and safety.

3.3.3 System Leakage Test

The licensee's proposed modification to Paragraph (h) of Code Case N-504-4 is to perform leak testing in accordance with ASME Code, Section XI, IWA-5000. Use of a leak test at normal operating temperature and pressure in lieu of a hydrostatic test has been incorporated in ASME Code, Section XI beginning in the 1998 Edition with the 1999 Addenda. The licensee is currently in its fourth 10-year ISI interval and the ISI Code of record for the fourth 10-year ISI interval is the 2001 Edition with 2003 Addenda of the ASME Code, Section XI. As the licensee's alternative is consistent with the current practice, the NRC staff accepts the licensee's alternative.

4.0 CONCLUSION

The use of the ASME Code Case N-504-4 requirements as an alternative to the ASME Code repair provisions, as modified by the licensee's alternatives discussed above, is acceptable to the NRC staff, provided that the license complies with all conditions and provisions specified in RG 1.147, Revision 16.

The NRC staff concludes that the alternative proposed in the licensee's Relief Request NDE-R014 to perform a WOL on components RRA-F002A and RRA-J003 would provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes Relief Request NDE-R014 for the installation of a WOL repair on components RRA-F002A and RRA-J003. This authorized alternative identified as Relief Request NDE-R014 is applicable to the fourth 10-Year ISI interval, which began November 1, 2006, and will end February 21, 2014.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Edward Andruszkiewicz

Dated: September 6, 2011

Mr. Peter Wells
Vice President
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

September 6, 2011

SUBJECT: DUANE ARNOLD ENERGY CENTER – RELIEF REQUEST NDE-R014
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Sincerely,
/RA/
Robert Pascarelli, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure: Safety Evaluation

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