June 12, 2007

Mr. Gary Van Middlesworth
Site Vice President
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER - SAFETY EVALUATION FOR REQUEST TO USE CODE CASES N-504-2 AND N-638-1 FOR WELD OVERLAY REPAIRS FOR ALTERNATIVE TO ASME SECTION XI REPAIR REQUIREMENTS (TAC NO. MD4466)

Dear Mr. Van Middlesworth:

By letter dated February 24, 2007, as supplemented by letters dated February 26, and February 28, 2007, FPL Energy Duane Arnold, LLC (FPL Energy) submitted a request for relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) at Duane Arnold Energy Center (DAEC). FPL Energy proposed to use ASME Code Cases N-638-1 and N-504-2, with modifications, specifically for the purpose of performing full structural weld overlays on certain reactor system welds.

The Nuclear Regulatory Commission (NRC) staff has completed its review of the relief request as documented in the enclosed Safety Evaluation (SE). The NRC staff concludes that the modifications proposed in the request for relief to perform full structural weld overlays on the Reactor Vessel N2C and N2F recirculation inlet nozzles, safe end-to-nozzle weld joint RRC-F002 and weld joint RRF-F002 dissimilar metal welds at DAEC will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternatives for the installation of full structural weld overlays, over the welds identified in the relief request, during refueling outage (RFO) 20.

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.

On March 6, 2007, prior to the completion of RFO 20, verbal authorization of the licensee's proposed alternatives were granted.

If you have any questions regarding this matter, please contact Mr. Karl Feintuch at

(301) 415-3079.

Sincerely,

/RA/ Patrick Milano for

L. Raghavan, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:
Safety Evaluation

cc w/encl: See next page

June 12, 2007

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Revised May 4, 2007

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF TO EXTEND

THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL AT THE

DUANE ARNOLD ENERGY CENTER

FPL ENERGY

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated February 24, 2007, as supplemented by letters dated February 26, and February 28, 2007, FPL Energy Duane Arnold (the licensee), proposed to use, with modifications, the repair requirements of the American Society of Mechanical Engineers (ASME) Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1" (N-504-2), and Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1" (N-638-1), of ASME Code, Section XI. The code cases, with modifications, would be used to perform full structural weld overlays (WOLs) on the Reactor Vessel N2C and N2F recirculation inlet nozzle, safe-end-to-nozzle weld joint RRC-F002 and RRF-F002 dissimilar metal welds. The subject welds were fabricated using Alloy 82, with Alloy 182 buttering. This safety evaluation is for the configuration of full structural WOLs.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR) 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will 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 Duane Arnold Energy Center (DAEC) is in its fourth 10-year ISI interval, which began November 1, 2006, and will end concurrent with the DAEC Operating License on February 21,2014. The ISI Code of record for DAEC for the fourth 10-year ISI interval is the ASME Code Section XI, 2001 Edition, including Addenda through 2003.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to requirements may be authorized by the U.S. Nuclear Regulatory Commission (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 alternatives to the implementation of the ASME Code, Section XI, Code Cases N-638-1 and N-504-2 for the deposition of WOLs for the remaining service life of the affected components.

3.0 TECHNICAL EVALUATION

3.1 Code Requirements for which Relief is Requested

Under the rules of IWA-4220, repairs shall be performed in accordance with the licensee's design specification and the original Construction Code. Later editions and addenda of the Construction Code or of ASME Section III, either in their entirety or portions thereof, and Code Cases may be used.

The licensee has requested to use Code Cases N-504-2 and N-638-1, which were conditionally approved by the NRC as specified in Regulatory Guide (RG) 1.147, Revision 14, as modified by the following proposed alternatives.

3.2 Licensee's Proposed Alternatives to Code Case N-504-2

- Code Case N-504-2 was prepared specifically to apply a weld overlay to austenitic stainless steel material. An alternative was required to implement the N-504-2 weld overlay methodology due to the specific materials and configuration of the existing nickel-based alloy weld and buttering (Alloy 82 and Alloy 182) and Alloy 600 safe ends.

- Code Case N-504-2, Requirement (b) requires that the weld overlay shall be low carbon (0.035 percent maximum) austenitic stainless steel. An alternative was required since a nickel-based filler (Alloy 52M) has been selected to be used.

- Code Case N-504-2, Requirement (e) requires that the first two layers of the weld overlay shall have a ferrite content of at least 7.5 FN (Ferrite Number). The licensee does not intend to perform these measurements for this type of overlay on the basis that the nickel alloy filler is a fully austenitic material.

- Code Case N-504-2, Requirement (h) specifies that a system hydrostatic test shall be performed, in accordance with ASME Section XI, IWA-5000, if the flaw penetrates the original pressure boundary. In the event a flaw becomes through wall, leak testing, in accordance with IWA-5000, will be performed.

3.3 Licensee's Proposed Alternatives to Code Case N-638-1

- Code Case N-638-1, paragraph 1.0(a) specifies that the maximum weld area on the finished low alloy steel surface shall be 100 square inches. Restoring the structural integrity of the safe end-to-nozzle weld will require application of the weld overlay on more than 100 square inches of surface on the low alloy steel base material.

- Code Case N-638-1, paragraph 4.0(b) specifies that the final weld surface and the band around the area (to a width of 1.5 times the thickness of the weld (1.5T) or 5 inches, whichever is less) shall be examined using surface and ultrasonic test (UT) methods, when the completed weld has been at ambient temperature for at least 48 hours. The UT shall be in accordance with ASME Section XI, Appendix I. Full UT examination of the 1.5T band will not be performed.

- Code Case N-638-1, paragraph 4.0© specifies that the area from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method. Thermocouples will not be used. Instead, calibrated pyrometers will be utilized to monitor preheat and interpass temperatures.

3.4 Licensee's Basis for Relief

A full structural weld overlay repair is proposed for the safe end-to-nozzle weldments. The nozzle material is SA-508 Class 2 low alloy steel. The safe end is Alloy 600 (SB-166). The existing weld material is Alloy 82 with Alloy 182 buttering.

The weld overlay will be designed consistent with the requirements of NUREG-0313, Revision 2 (which was implemented by Generic Letter 88-01), Code Case N-504- 2, Code Case N-638-1, and IWB-3640, and Appendix C from the 2001 Edition through 2003 Addenda of ASME Code Section XI.

The use of an overlay filler material that provides excellent resistance to stress corrosion cracking (SCC) creates an effective barrier to flaw extension. Also, temper bead welding techniques produce excellent toughness and ductility in the weld heat-affected zone (HAZ) of low alloy steel materials and, in this case, results in compressive residual stresses on the inside surface that help to inhibit further SCC of the original weldment. The design of the overlay for the safe end-to-nozzle weldment uses methods that are standard in the industry. There are no new or different approaches in this overlay design which would be considered either a first-of-a-kind or inconsistent with previous approaches.

The overlay will be designed as a full structural weld overlay in accordance with Code Case N-504-2. The temper bead welding technique, that will be implemented in accordance with Code Case N-638-1, will produce a tough, ductile, corrosion-resistant overlay.

3.5 Conditions for Code Case N-504-2 and N-638-1 accepted in RG 1.147

Use of Code Cases N-504-2 and N-638-1 has been accepted in RG 1.147, Revision 14, with the following conditions as limitations providing an acceptable level of quality and safety.
Code Case N-504-2 Limitation:

The provisions of Section XI, Non-Mandatory Appendix Q, "Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments," must be met. DAEC intends to meet the associated requirements contained in this non-mandatory Appendix Q.

Code Case N-638-1 Limitation:

UT examinations shall be demonstrated for the repaired volume using representative samples which contain construction type flaws. The acceptance criteria of NB-5330 of the Section III edition and addenda approved in 10 CFR 50.55a apply to all flaws identified in the repair volume. The DAEC intends to implement this limitation.

3.6 Licensee's Basis for the Alternatives

Code Case N-504-2 Requirement (b) Alternative:

Code Case N-504-2, Requirement (b) requires that the weld overlay be low carbon (0.035 percent maximum) austenitic stainless steel. A consumable welding wire, highly resistant to SCC, was selected for the overlay material. This material, designated as UNS N06054, F-No. 43, is a nickel-based alloy weld filler material, commonly referred to as Alloy 52M, and will be deposited using the machine gas tungsten arc welding (GTAW) process, with cold wire feed. Alloy 52M contains about 30 percent by weight (wt percent) chromium, which imparts excellent corrosion resistance to the material. By comparison, Alloy 82 is identified as a SCC-resistant material in NUREG-0313, Revision 2 and contains nominally 20 wt percent chromium, while Alloy 182 has a nominal chromium content of 15 wt percent. With its higher chromium content than Alloy 82, Alloy 52M provides a level of resistance to SCC consistent with the requirements of the Code Case. Therefore, this alternative provides an acceptable level of quality and safety.

Code Case N-504-2, Requirement (e) Alternative:

Code Case N-504-2, Requirement (e) requires the first two layers of the weld overlay to have a ferrite content of at least 7.5 FN (Ferrite Number). The composition of nickel-based Alloy 52M is such that delta ferrite does not form during welding because Alloy 52M welds are 100 percent austenitic and contain no delta ferrite due to the high nickel composition (approximately 60 wt percent nickel). Consequently, delta ferrite measurements of the overlay are not intended to be performed by DAEC Therefore, this alternative provides an acceptable level of quality and safety.

Code Case N-504-2, Requirement (h) Alternative:

Code Case N-504-2, Requirement (h) specifies that a system hydrostatic test be performed, in accordance with IWA-5000, if the flaw penetrates the original pressure boundary. Leak testing, in accordance with ASME Section XI (2001 Edition with the 2003 Addenda), IWA-5000, will be performed. Precedence for use of a leak test at normal operating temperature and pressure in lieu of a hydrostatic test was established by Code Case N-416-1, which has been incorporated in ASME Section XI beginning in the 1998 Edition with the 1999 Addenda. Therefore, this alternative provides an acceptable level of quality and safety.

Code Case N-638-1, Paragraph 1.0(a) Alternative:

Code Case N-638-1 paragraph 1.0(a) specifies that the maximum weld area on the finished surface shall be 100 square inches. Restoring the structural integrity of a safe end-to-nozzle weld will require application of the weld overlay on more than 100 square inches of surface on the low alloy steel base material. The weld overlay will cover approximately 180 square inches of the low alloy steel nozzle. Code Case N-432 “Repair Welding Using Automatic or Machine Gas Tungsten-Arc Welding (GTAW) Temper Bead Technique, Section XI, Division 1," (N-432), allows temper bead welding on low alloy steel nozzles, without limiting the temper bead weld surface area. The two additional conditions required by N-432, that are not required by Code Case N-638-1, are (1) that temper bead welds have preheat applied and (2) that the procedure qualification be performed on the same specification, type, grade and class of material. Elevated preheat necessitates draining of the reactor pressure vessel and a portion of the recirculation system piping. By removing the water in the pipe, nozzle area, and (in vessel) inlet riser, a large amount of shielding is removed. The radiation dose rates at the weld overlay location would increase, thereby significantly increasing personnel dose.

The ASME Code committees have recognized that the 100 square inches restriction on the surface area is unnecessarily limiting, and Code Case N-638-3 has been issued to increase the surface area limit to 500 square inches. The code case attempts to combine the features of Code Case N-432 and N-638 into a single code case. The supporting analysis for the code case is found in Electric Power Research Institute (EPRI) Technical Report 1008454, “Expansion of Temperbead Repair: Proposed Code Case,” which concluded that the residual stresses are not detrimentally changed by increasing the surface area of the repair. The technical basis that justifies exceeding 100 square inches of surface area for repair welds is found in EPRI Technical Report 1003616, “Additional Evaluations to Expand Repair Limits for Pressure Vessels and Nozzles.” This technical report describes an ANSYS Finite Element Analysis conducted on the Nine Mile Point, Unit 2 feedwater nozzle weld overlay repair. The analysis consisted of modeling the welding processes for both thermal and mechanical aspects. Two overlays were modeled: one was 100 square inches, the other was extended to blend into the nozzle radius to achieve greater than the 100 square inches surface area repair currently permitted by the ASME Code requirements. Comparison of the residual stresses of the two overlays showed that the effect of extending the overlay to the nozzle radius minimally impacted the residual stress profile and, in some cases, slightly increased the beneficial compressive stresses on the nozzle inner diameter. In this instance, the weld overlay on each of these two nozzles will not exceed 260 square inches on the low alloy nozzle. Therefore, this alternative provides an acceptable level of quality and safety.

Code Case N-638-1, Paragraph 4.0(b) Alternative:

Code Case N-638-1 Paragraph 4.0(b) specifies that the final weld surface and band area (1.5T width or 5 inches, whichever is less) shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. The UT shall be in accordance with ASME Section XI, Appendix I. Per this requirement, surface exams will be performed. Since ASME Section XI, IWA-4634 requires UT of the weld only, full UT of the 1.5T band will not be performed. The weld overlay will extend into the blend radius of the nozzle beyond the length required by Code Case N-504-2 for structural reinforcement. This extension onto the blend radius eliminates a stress riser on the nozzle and provides additional outside diameter surface area for UT examination of the defect area. UT examination on the nozzle beyond the overlay will not provide any information regarding the area of the defect that required repair. Additionally, such UT would likely be unsatisfactory when applied to the nozzle blend

radius, where the toe of the weld overlay resides. The UT return signal would be difficult to obtain and to interpret. Alternatively, surface examination will assure that no defects have been created at the toe of the weld overlay. This surface examination will extend to 1.5 inches up on the nozzle. This alternative provides an acceptable level of quality and safety.

Code Case N-638, Paragraph 4.0© Alternative:

Code Case N-638-1 paragraph 4.0© specifies that the area from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method. Due to the personnel exposure associated with the installation and removal of the thermocouples, due to the nozzle configuration, and because the nozzle will be full of water, thermocouples will not be used to verify that the preheat and interpass temperature limits are met. In lieu of thermocouples, a contact pyrometer will be used to verify preheat temperature and interpass temperature compliance with the welding procedure specification (WPC) requirements. This alternative provides an acceptable level of quality and safety.

3.7 NRC Staff Evaluation of Modifications to N-504-2

Under the rules of ASME Section XI, IWA-4220, weld repairs shall be performed in accordance with the licensee's design specification and the original Construction Code. Later editions and addenda of the Construction Code or of ASME Section III, either in their entirety or portions thereof, and Code Cases may be used. Defects in welds shall be removed or reduced in size, in accordance with ASME Section XI, IWA-4400. Code Case N-504-2 is being used by the licensee to perform full structural WOLs on the Reactor Vessel N2C and N2F recirculation inlet nozzles, safe end-to-nozzle weld joint RRC-F002 and RRF-F002 dissimilar metal welds. Code Case N-504-2 was conditionally approved by the NRC staff for use under RG 1.147, Revision 14. Therefore, the use of N-504-2 as an alternative to the mandatory ASME Code repair provisions is acceptable to the NRC staff, provided that there is compliance with all conditions and provisions specified in RG 1.147, Revision 14.

The first proposed modifications to the N-504-2 provisions involve the use of a nickel-based alloy weld material, rather than the low carbon austenitic stainless steel. The licensee stated that Paragraph (b) of N-504-2 requires that the reinforcement weld material shall be low carbon (0.035 wt percent maximum) austenitic stainless steel. In lieu of the stainless steel weld material, Alloy 52M, a consumable welding wire highly resistant to SCC, was proposed for the overlay weld material. The NRC staff notes that the use of 52M material is consistent with weld filler material used to perform similar weld overlays at other operating boiling-water reactor (BWR) facilities. The NRC staff also notes that the licensee is performing full structural WOLs on dissimilar metal welds made of Alloy 182 material. For dissimilar material compatibility in welding, the NRC staff considers that Alloy 52M is a better choice of filler material than austenitic stainless steel material for this type of weld joint configuration. Alloy 52M contains about 30 percent chromium, which would provide excellent resistance to SCC, if exposed to the reactor coolant environment. This material is identified as having a F-No. 43 Grouping for Ni-Cr-Fe classification UNS N06052 Filler Metal and has been previously approved by the NRC staff for similar applications. Therefore, the licensee's proposed use of Alloy 52M for the weld overlays as a modification to the requirements of N-504-2, paragraphs (b) and (e) is acceptable as it will provide an acceptable level of quality and safety.

The next proposed modification to the N-504-2 provisions involves paragraph (e) of N-504-2 which requires as-deposited delta ferrite measurements of at least 7.5 FN for the weld reinforcement. The licensee proposed that delta ferrite measurements will not be performed for this overlay because the deposited Alloy 52M material is 100 percent austenitic and contains no delta ferrite due to the high nickel composition (approximately 60 wt percent nickel). N-504-2 allows the use of weld overlay repair by deposition of weld reinforcement on the outside surface of the pipe in lieu of mechanically reducing the defect to an acceptable flaw size. However, N-504-2 is designed for weld overlay repair of austenitic stainless steel piping. Therefore, the material requirements regarding the carbon content limitation (0.035 wt percent maximum) and the delta ferrite content of at least 7.5 FN, as delineated in N-504-2, paragraphs (b) and (e), apply only to austenitic stainless steel weld overlay materials, to ensure its resistance to SCC. These requirements are not applicable to Alloy 52M, a nickel-based material, which the licensee will use for the weld overlays.

The licensee's proposed modification to Paragraph (h) of N-504-2 is to perform leak testing in accordance with ASME Section XI (2001 Edition with the 2003 Addenda), IWA-5000. Precedence for use of a leak test at normal operating temperature and pressure in lieu of a hydrostatic test was established with Code Case N-416-1, which has been incorporated in ASME Section XI beginning in the 1998 Edition with the 1999 Addenda. The underlying rationale of Code Case N-416-1 is equally applicable to this instance. DAEC is currently in its fourth 10-year ISI interval, which began November 1, 2006, and will end concurrent with the DAEC Operating License expiration on February 21, 2014. The ISI Code of record for DAEC for the fourth 10-year ISI interval is the ASME Code Section XI, 2001 Edition, including Addenda through 2003. Therefore, this alternative provides an acceptable level of quality and safety.

3.8 Staff Evaluation of Modifications to N-638-1

The licensee is applying a 360-degree, full structural WOL to reduce the susceptibility of the original weld to the initiation and growth of SCC and ultimately to maintain weld integrity. The full structural WOL will fulfill all structural requirements, independent of the existing weld. Operational experience has also shown that SCC in Alloy 82/182 will blunt at the interface with stainless steel base metal, carbon steel base metal, or Alloy 52/152 weld metal, if cracking were to occur.

To eliminate the need for preheat and post-weld heat treatment under the Construction Code, the industry developed requirements for implementation of a temper bead welding technique which were published in N-638-1. The NRC endorsed N-638-1 in RG 1.147, Revision 14. The temper bead technique carefully controls heat input and bead placement, which allows subsequent welding passes to stress relieve and temper the HAZ's of the base material and preceding weld passes. The welding is performed with low hydrogen electrodes under a blanket of inert gas. The inert gas shields the molten metal from moisture and hydrogen. Therefore, the need for the preheat and post-weld heat treatment, specified by the ASME Construction Code, is not necessary to produce a sound weld, using a temper bead welding process, which meets the requirements of N-638-1.

The licensee intends to meet the requirements of N-638-1, except paragraph 1.0(a), which requires the maximum area of an individual weld, based on the finished surface, be limited to 100 square inches and the depth of the weld to exceed one-half of the ferritic base metal thickness. This condition is not being met because the design for the weld overlay covers an

area up to approximately 260 square inches, which exceeds the limitations of N-638-1. The licensee will perform an evaluation to determine the effect of exceeding the 100 square inch area limitation for temper bead welding onto a low alloy steel nozzle. This evaluation will be conducted per N-504-2. Paragraphs (g)(2) and (g)(3) of N-504-2 require consideration of the effects of residual stresses produced by the weld overlay, when coupled with other applied loads on other welds and components throughout the system. The evaluation of other welds and components in the system is to consider potential increases in loading, including shrinkage effects, due to all weld overlays in the reactor coolant system. These welds and components must meet the applicable stress limits of the Construction Code.

The NRC staff considers this evaluation, which is a N-504-2 requirement, important in assuring that the reactor coolant system will not be adversely effected after WOLs are deposited. EPRI has performed studies to qualify weld overlays for application in BWRs, and in these applications, the studies have not identified any issues with shrinkage stresses or weld contraction stresses.

The NRC staff notes that several similar weld overlays have been applied to BWR facilities (such as Nine Mile Point 2, Perry, and Duane Arnold) with similar geometry and overlay dimensions. The DAEC weld overlay design is generally similar to the design applied to BWR feedwater, core spray, and recirculation nozzles. Information published in publicly available sources (Reference 1) shows that compressive stresses are generated on the inside surface of a pipe by weld overlays in excess of 100 square inches. In some cases, the extended overlay results in higher compressive stress than the 100 square-inch case. Thus, increasing the overlay area is acceptable for this specific application, i.e., to support the mitigation of the SCC degradation mechanism and in this geometry (piping). Based on the preceding discussions, the NRC staff concludes that the modification to increase the WOL to a maximum of 260 square inches will provide an acceptable level of quality and safety and is, therefore, acceptable.

The second modification requested by the licensee is that full UT of the 1.5T band, which is required under Paragraph 4.0(b), will not be performed. Using Code Case N-638-1, the temper bead weld is for filling a cavity in the base metal. The licensee's application, however, is for a structural weld overlay above the base metal, which results in a contour that is UT inspectible except for the edge taper where the overlay transitions to the nozzle surface and on the curvature of the nozzle. The proposed weld edge configuration has the same UT examination difficulties as are considered under ASME Section XI, Appendix Q. Appendix Q only requires a surface examination of the tapered area of the weld overlay. In addition to verifying the soundness of the weld, a purpose of the UT is to assure that delayed cracking due to hydrogen introduced during the temper bead welding process, or cracking in unannealed ferritic material, does not occur. In the unlikely event cracking does occur, it would be initiated on the surface on which the welding is actually performed or in the HAZ immediately adjacent to the weld.

The most appropriate technique to detect surface cracking is the surface examination technique. Per the foregoing, the use of a surface examination in the area of the weld overlay taper and band beyond the toe of the overlay on the ferritic material is acceptable in that it provides an acceptable level of safety and quality.

Code Case N-638-1 paragraph 4.0© specifies that the area from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method. The licensee has stated that, due to the personnel exposure associated with the

installation and removal of the thermocouples, the nozzle configuration, and because the nozzle will be full of water, thermocouples will not be used to verify that the preheat and interpass temperature limits are met. In lieu of thermocouples, a contact pyrometer will be used to verify preheat temperature and interpass temperature compliance with the WPS requirements.

The preheat temperature required for this welding is 50 °F. The maximum interpass temperatures required for this welding are 150 °F for the first three layers, and 350 °F for the balance of welding. A contact pyrometer can be used to adequately monitor these preheat and interpass temperatures. Also, the large mass of the nozzle coupled with the low heat input gas tungsten arc weld (GTAW) process should help ensure that the maximum interpass temperature will not be exceeded. The alternate temperature measurement method will ensure that a close control will be maintained on these temperatures. Therefore, this type of temperature measurement will provide an acceptable level of quality and safety.

4.0 CONCLUSION

Based on the discussion above, the NRC staff concludes that the request to perform full structural weld overlays on the Reactor Vessel N2C and N2F recirculation inlet nozzles, safe end-to-nozzle weld joint RRC-F002 and weld joint RRF-F002 dissimilar metal welds at DAEC, with the modifications proposed in the request for alternative, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternatives for the installation of full structural WOLs over the welds identified in the relief request during refueling outage RFO 20.

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.

5.0 REFERENCE

1. *Materials Reliability Program: Technical Basis for Preemptive Weld Overlays for Alloy 82/182 Butt Welds in PWRs (MRP-169),* EPRI, Palo Alto, CA, and Structural Integrity Associates, Inc., San Jose, CA: 2005. 1012843, ADAMS No. ML0525602200.

Principal Contributor: E. Andruszkiewicz
K. Feintuch

Date: June 12, 2007