September 12, 2007

Mr. Michael Balduzzi
Sr. Vice President, Regional Operations NE
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: PALISADES NUCLEAR PLANT - RELIEF REQUEST 1 FOR THE REPAIR OF REACTOR VESSEL CLOSURE HEAD PENETRATIONS (TAC NO. MD3092)

Dear Mr. Balduzzi:

By letter dated September 15, 2006, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML062580396), Nuclear Management Company, LLC (NMC, the licensee, at the time of submittal) requested relief from certain sections of the 2001 Edition of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*, Section XI (ASME Code) with addenda through 2003 for Palisades Nuclear Plant. Relief Request No. 1 pertains to the repair of the control rod drive (CRD) nozzles and incore instrumentation (ICI) nozzles on the reactor vessel closure head (RVCH). Relief Request No. 2 will be addressed by a separate correspondence. Entergy Nuclear Operations, Inc (ENO), has since become the current licensee, following a license transfer that occurred on April 11, 2007.

The Nuclear Regulatory Commission (NRC) staff has reviewed your proposal and concludes that Relief Request No. 1 is acceptable as discussed in the enclosed safety evaluation. The NRC staff concludes that the licensee's proposed alternatives to flaw repair and inspection for the CRD nozzles and ICI nozzles of the RVCH provide an acceptable level of quality and safety. The staff also concludes that the proposed alternatives provide reasonable assurance of structural integrity. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* Section 50.55a(a)(3)(i), Relief Request No. 1 for the repair of the CRD nozzles and ICI nozzles of the RVCH is authorized through the end of the fourth 10-year inservice inspection interval.

All other requirements of the ASME Code, Sections III, IX and XI, for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

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

Docket No. 50-255

Enclosure:
Safety Evaluation

cc w/encl: See next page

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ADAMS Accession Number: ML071900251 * Safety Evaluation dated: June 25, 2007, *Per memo dated 6/25/07

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REACTOR VESSEL CLOSURE HEAD NOZZLE PENETRATION REPAIR

FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL

RELIEF REQUEST NO. 1

PALISADES NUCLEAR PLANT

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-255

1.0 INTRODUCTION

By letter dated September 15, 2006, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML062580396), Nuclear Management Corporation (NMC, the licensee at the time of submittal) requested relief from certain sections of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel* (B&PV) *Code*, Section XI, 2001 Edition through the 2003 Addenda. The relief request pertains to the repair of the control rod drive (CRD) nozzles and incore instrumentation (ICI) nozzles on the reactor vessel closure head (RVCH). The licensee will be inspecting the RVCH, CRD nozzle penetrations, and ICI nozzle penetrations during the fall 2007, refueling outage at the Palisades Nuclear Plant (PNP), in accordance with Nuclear Regulatory Commission (NRC) Order, EA-03-009, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004. This request was submitted in the event that a RVCH nozzle penetration requires repair at PNP. Entergy Nuclear Operations, Inc has since become the current licensee, following a license transfer that occurred on April 11, 2007.

The licensee requested and received NRC approval (April 3, 2006, ADAMS Accession No. ML060800319) for repair of the CRD nozzle penetrations and ICI nozzle penetrations on the RVCH during the third 10-year inservice inspection (ISI) interval at PNP which ended December 12, 2006. The current request seeks similar approval for the fourth 10-year ISI interval.

2.0 REGULATORY EVALUATION

The ISI of ASME Code Class 1, Class 2, and Class 3 components is to be performed in accordance with the ASME Code Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulation* (10 CFR) Section 50.55a(g), except where specific relief has been granted

by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Paragraph 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would 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.

Pursuant to 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 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 ISI code of record for Palisades' fourth 10-year interval is the 2001 Edition through the 2003 Addenda of ASME Code Section XI.

3.0 ALTERNATE REPAIR TECHNIQUE FOR REACTOR VESSEL HEAD PENETRATIONS RELIEF REQUEST NO. 1

3.1 Components for Which Relief Is Requested

The components for which relief is requested are the RVCH, 45 CRD nozzle penetrations, and 8 ICI nozzle penetrations.

3.2 Applicable ASME Code Edition and Requirements

ASME Code Section XI, IWA-4220 specifies the Code usage requirements for repair/replacement activities. The original construction code for the PNP RVCH is ASME Code Section III, 1965 Edition, including addenda through winter 1965. The licensee indicated that the proposed repairs will be conducted in accordance with the 2001 Edition of ASME Code Section XI, with addenda through 2003, the 1989 Edition of ASME Code Section III, no addenda, as supplemented by the alternative requirements discussed in its relief request.

3.3 Licensee's Proposed Alternative

As an alternative to Code requirements, the licensee proposed to use the welding technique as discussed in its submittal dated September 15, 2006. Due to the risk of damage to the RVCH material properties or dimensions and the additional radiological dose that would be required, it is not feasible to apply the post-weld heat treatment requirements of paragraph NB-4622 of the 1989 ASME Code Section III, to the RVCH or the elevated temperature preheat and post weld soak required by the alternative temper bead method offered by ASME Code Section XI, IWA-4600.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requests relief to use an ambient temperature temper bead welding method as an alternative to the welding requirements of ASME Code Section III, NB-4622,1989 Edition, no addenda. The licensee is requesting relief on the basis that the proposed alternative provides an acceptable level of quality and safety.

The licensee requests relief to use a welding repair based on the ambient temperature temper bead method as an alternative to the requirements of the 1989 Edition of ASME Code Section III, NB-4453, NB-4622, NB-5245, and NB-5330. The alternative includes a request to use filler material, Alloy 52 American Welding Society Class ERNiCrFe-7/UNS No. 06052, which is endorsed by Code Case 2142-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNC N06052 Filler Material," for the weld repair. Portions of Code Case N-638-1, “Similar and Dissimilar Metal Welding Using Ambient Temperature Machine [Gas Tungsten Arc Welding] GTAW Temper Bead Technique," which has been approved in Regulatory Guide 1.147, “Inservice Inspection Code Case Acceptability - ASME Section XI Division 1," Revision 14, were used as a template for the licensee’s proposed repair.

Repairs to the RVCH, CRD, and ICI penetration nozzles will be made in accordance with the requirements of IWA-4000, of the 2001 Edition of ASME Code Section XI, with addenda through 2003. The requirements of paragraphs NB-4622, NB-3300, and NB-5245, of the 1989 Edition of ASME Code Section III, and QW-256 of the 1989 Edition of ASME Code Section IX, are applicable to the potential repairs. The detailed description of the applicable licensee alternatives to these requirements are listed in Enclosure 1 of the licensee’s September 15, 2006, submittal.

The following sections of ASME Code Section III or portions, thereof, do not apply to the licensee’s proposed alternative: NB-4622.1, NB-4622.2, NB-4622.3, NB-4622.4, NB-4622.5, NB-4622.6, NB-4622.7, NB-4622.8, NB-4622.9, NB-4622.10, NB-4622.11(c), NB-4622.11(f), NB-4622.11(d)(1), NB-4622.11(d)(2), NB-4622.11(d)(3), NB-4622.11(g), NB-4453.4, NB-5330(b).

QW-256 of ASME Code Section IX or portions thereof, described in the licensee’s submittal, do not apply to the licensee’s proposed alternative and will not be met.

The licensee’s proposed repair method uses ASME Code Section XI Code Case N–638-1 as a guide with exception to the following sections: 2.1(b), 2.1(c), 2.1(h), 2.1(j), 3.0(c), 3.0(d), 3.0(e), 4.0(b), 4.0(c), 4.0(e) which will not be met.

A complete description of the licensee’s repair method and a detailed description of the licensee’s basis for use is located in its September 15, 2006, relief request submittal. Palisades requests approval of the proposed alternative for the remainder of the fourth 10-year interval of the ISI Program for PNP, which began on December 13, 2006.

4.0 STAFF EVALUATION

The licensee requested and received approval from the NRC for a similar alternative technique to repair the PNP reactor pressure vessel head penetrations for the third 10-year ISI interval. The licensee’s alternative for its third 10-year ISI interval was approved by NRC letter, dated April 3, 2006. The current request is for the fourth 10-year ISI interval.

The 1989 Edition of ASME Code Section III, paragraph NB-4622.11, "Temper Bead Weld Repair to Dissimilar Metal Welds or Buttering" states that whenever post-weld heat treatment is impractical or impossible, limited weld repairs to dissimilar metal welds of P-No. 1 and P-No. 3 material or weld filler metal A-No. 8 (Section IX, QW-442) or F-No. 43 (Section IX, QW-432) may be made without post-weld heat treatment, or after the final post-weld heat treatment, provided the requirements of the paragraphs NB-4622.11(a) through (g) are met. The NRC staff's evaluation of specific deviation from the ASME Code requirements are discussed below.

NB-4622.1 through NB-4622.7 establish various requirements for post-weld heat treatment of welds. Since the repair welds will not be post-weld heat treated per the licensee's alternative repair method, the NRC staff agrees with the licensee that these paragraphs do not apply to the proposed repair method.

NB-4622.8 establishes exemptions from post-weld heat treatment for nozzle to component welds and branch connection to run piping welds. NB-4622.8(a) establishes criteria for exemption of post-weld heat treatment for partial penetration welds. The NRC staff agrees with the licensee that NB-4622.8(a) is not applicable to the proposed repair because the criteria involves buttering layers at least 1/4-inch thick which will not exist for the welds made by the proposed temper bead process. The NRC staff finds that NB-4622.8(b) also does not apply because it discusses full penetration welds and the welds in question are partial penetration welds.

NB-4622.9 establishes requirements for temper bead repairs to P-No. 1 and P-No. 3 materials and A-Nos. 1, 2, 10, or 11 filler metals. The NRC staff agrees with the licensee that NB-4622.9 does not apply to the proposed repairs because the proposed repairs will use a filler metal (F-No. 43) that is different from the above requirements.

NB-4622.10 establishes requirements for repair welding to cladding after post-weld heat treatment. The NRC staff agrees with the licensee that NB-4622.10 does not apply because the proposed repair alternative does not involve repairs to cladding.

NB-4622.11(a) requires surface examination prior to repair in accordance with Article NB-5000. The NRC staff finds that the licensee has satisfied this requirement because the proposed alternative will include surface examination prior to repair.

NB-4622.11(b) contains requirements for the maximum extent of repair. The NRC staff finds that the licensee has satisfied this requirement because the proposed alternative includes the same limitations on the maximum extent of repair.

NB-4622.11(c) discusses the repair welding procedure and welder qualification in accordance with ASME Code Section IX, and the additional requirements of Article NB-4000. The NRC staff finds that the licensee has satisfied this requirement because the proposed alternative will satisfy these requirements, except for the stipulations of paragraph QW-256 of ASME Code Section IX. The NRC staff evaluation of QW-256 is discussed later.

NB-4622.11(c)(1) requires the area to be welded be suitably prepared for welding in accordance with the written procedure to be used for the repair. The NRC staff finds that the licensee has satisfied this requirement because the proposed alternative will include welding preparation which is discussed in Enclosure 1 of the September 15, 2006, submittal.

NB-4622.11(c)(2) requires the use of the shielded metal arc welding process with covered electrodes meeting either the A-No. 8 or F-No. 43 classifications. The proposed alternative uses gas tungsten arc welding which utilizes a non-consumable tungsten electrode with bare filler metal meeting the F-No. 43 classification. The temper bead gas tungsten arc welding technique has been shown effective by research, successful procedure qualifications, and welding procedure specifications which have been used to perform many successful repairs since the technique was developed. It has been shown that adequate toughness can be achieved in base metal and heat affected zones with the use of a temper bead technique that utilizes the gas tungsten arc welding process. Therefore, the NRC staff finds that the gas tungsten arc welding process utilizing the temper bead welding technique is acceptable for use in lieu of the shield metal arc welding process.

NB-4622.11(c)(3) discusses requirements for covered electrodes pertaining to hermetically-sealed containers or storage in heated ovens. The NRC staff finds that these requirements do not apply because the proposed alternative uses bare metal filler material and non-consumable tungsten electrodes which are not susceptible to moisture pickup from the atmosphere.

NB-4622.11(c)(4) discusses requirements for storage of covered electrodes during repair welding. The NRC staff finds that these requirements do not apply because the proposed alternative uses bare metal filler material and a non consumable tungsten electrode, which do not require any special storage conditions to prevent the pickup of moisture from the atmosphere.

NB-4622.11(c)(5) requires preheat of the weld area to a minimum temperature of 350 °F prior to repair welding. Data from welding procedure qualification tests using the machine gas tungsten arc welding based on the ambient temperature temper bead process show that quality temper bead welds can be performed with a 50 °F minimum preheat and no post-weld heat treatment. The NRC staff agrees with the licensee that NB-4622.11(c)(5) does not apply because the proposed alternative does not require elevated preheat temperature.

NB-4622.11(c)(6) establishes requirements for electrode diameters for the first, second, and subsequent layers of the repair weld and requires removal of the weld bead crown before deposition of the second layer. The proposed alternative uses weld filler metal much smaller than the 3/32, 1/8, and 5/32 inch electrodes required by NB-4622.11(c)(6). Also, the use of the automatic or machine gas tungsten arc welding based on the ambient temperature temper bead process allows more precise control of heat input, bead placement, and bead size and contour than the manual shielded metal arc welding process required by ASME Code Sections III and XI. 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. Therefore, the NRC staff finds that these requirements do not apply to the proposed alternative.

NB-4622.11(c)(7) requires the preheated area to be heated from 450 °F to 660 °F for a minimum period of 4 hours after at least 3/16 inch of weld metal has been deposited. This requirement is intended to facilitate the diffusion of hydrogen away from the weld heat affected zone (HAZ). The licensee's alternative utilizes an extremely low hydrogen welding process and thus makes a post weld bake unnecessary. Therefore, the staff finds the licensee's alternative to not perform a post weld bake out acceptable.

NB-4622.11(c)(8) requires welding subsequent to the hydrogen bake-out of subparagraph NB-4622.11(c)(7) be done with a minimum preheat of 100 °F and maximum interpass temperature of 350 °F. The proposed alternative limits the interpass temperature to 350 °F and requires the area to be welded be at least 50 °F prior to welding. The aforementioned requirement of a minimum preheat of 100 °F does not apply because the proposed alternative is based on a minimum preheat temperature of 50 °F. Ambient temperature temper bead welding using the GTAW process with a 50 °F preheat has been proven to produce sound welds in laboratory testing and several field applications and is therefore acceptable.

NB-4622.11(d)(1) requires a liquid penetrant examination after the hydrogen bake-out described in subparagraph NB-4622.11(c)(7). The proposed alternative does not require the hydrogen bake-out because the low-hydrogen, ambient-temperature temper bead welding process makes it unnecessary. However, the licensee will perform a post-weld liquid penetrant examination of the final weld. The NRC staff finds the proposed alternative satisfies NB-4622.11(d)(1) and, therefore, is acceptable.

NB-4622.11(d)(2) requires penetrant testing and radiographic testing of repair welds after a minimum of 48 hours at ambient temperature. Also, repair welds shall be volumetrically examined, if practical, by the ultrasonic method after the completed repair weld has been at ambient temperature for at least 48 hours. The proposed alternative requires liquid penetrant and ultrasonic examination. The NRC staff agrees with the licensee that the geometry of the RVCH and the orientation of the inner bore of the RVCH nozzles make effective radiographic testing impractical. The thickness of the RVCH limits the sensitivity of the detection of defects in the new pressure boundary weld. The density changes between the base and weld metal, and residual radiation from the base metal, would render the radiographic film image inconclusive. Due to the high area dose which would cause fogging of the film and changing radius of the reactor vessel head which would cause geometric unsharpness condition, the NRC staff concludes that radiographic testing is ineffective for this type of repair.

Ultrasonic testing (UT) is used to identify features that reflect sound waves. The degree of reflection depends largely on the physical state of matter on the opposite side of the reflective surface and, to a lesser extent, on specific physical properties of the matter (density). For example, sound waves are almost completely reflected at metal-gas interfaces and partially reflected at metal-to-solid interfaces. Discontinuities that act as metal-gas interfaces, such as cracks, laminations, shrinkage cavities, and bonding faults, can be detected. Inclusions and other metal inhomogeneities can also be detected by partial reflection of the sound wave. The NRC staff believes that the use of UT coupled with a surface examination, will provide an acceptable inspection. On the basis of above evaluation, the NRC staff finds that ultrasonic examination and surface examination are an acceptable alternative to radiographic testing of the new welds.

NB-4622.11(d)(3) requires that all nondestructive examination be in accordance with NB-5000. The proposed alternative will comply with NB-5000, except that the progressive liquid penetrant examination required by NB-5245, will not be performed. See the staffs discussion pertaining to NB-4453.4 below.
NB-4622.11(e) establishes the requirements for documentation of the weld repairs in accordance with subarticle NB-4130. The licensee stated that the proposed alternative will comply with these requirements. Therefore, the NRC staff finds NB-4622.11(e) is satisfied.

NB-4622.11(f) establishes requirements for the procedure qualification test plate. The licensee stated that the proposed alternative complies with these requirements. Therefore, the NRC staff finds NB-4622.11(f) is satisfied.

NB-4622.11(g) establishes requirements for welder performance qualification relating to physical obstructions that might impair the welder's ability to make sound repairs which is particularly pertinent to the manual shielded metal arc welding process. The proposed alternative involves a machine gas tungsten arc welding process and requires welding operators be qualified in accordance with ASME Code Section IX. The NRC staff finds that the proposed alternative is acceptable because the use of a machine welding process, as is proposed herein, eliminates the concern about obstructions, which might interfere with the welder's abilities to make sound welds.

NB-4453.4 requires that the examination of repair welds be conducted in accordance with the requirements of the original welds. The proposed welds will be partial penetration welds as defined in NB-4244(d) and will meet the weld design requirements of NB-3352.4(d). The proposed partial penetration welds require examination in accordance NB-5245 which specifies a progressive surface examination. The licensee proposed to perform a surface examination and ultrasonic examination of the completed weld in lieu of a progressive surface examination. A ultrasonic examination coupled with a final weld surface examination provides a more robust examination than a progressive surface examination alone. The NRC staff finds that the proposed alternative provides adequate nondestructive examinations and is, therefore, acceptable.

NB-5330(b) does not allow any cracks or incomplete penetration regardless of length. As a result of the geometry and the inherent welding characteristics of the filler materials used in the repair, a linear indication, referred to as a "weld anomaly" by the licensee, may occur at the intersection of the RVCH, the nozzle, and the first intersecting weld bead (triple point). The proposed alternative will allow this triple point indication to remain.

The weld anomaly that the licensee refers to is not uncommon in weld fabrication involving partial penetration or lap joint type welds comprised of ferritic material, nickel alloys and nickel alloy filler metal using the GTAW process. It is sometimes unavoidable under the best fabrication circumstances. In the case of the licensee's request, it plans to perform a UT examination that will detect any anomalies and evaluate them for acceptance under ASME Code Section XI. The licensee indicated that fracture mechanics analysis were performed by AREVA to evaluate a 0.10-inch semi-circular flaw that is 360 degrees around the circumference at the "triple point" location where the Alloy 600 original nozzle or Alloy 690 replacement nozzle, the Alloy 52/52M weld, and the low alloy RCVH meet. The results of the analysis presented in the licensee's September 15, 2006, letter, regarding triple point weld flaws are acceptable to the NRC staff and are discussed in further detail in the NRC staff's safety evaluation of Relief Request No. 2 of the licensee's September 15, 2006, submittal. In addition, the NRC staff notes that any repaired nozzles are required to be inspected each refueling outage per the requirements of NRC First Revised Order, EA-03-009 and in the event that a flaw were to begin to grow, volumetric examinations performed during each refueling outage would provide detection of changing flaw dimensions.

QW-256 of ASME Code Section IX, requires that the maximum interpass temperature during procedure qualification be no more than 100 °F below that used for actual welding. The

licensee alternative requires a minimum preheat temperature of 50 °F, a 150 °F maximum interpass temperature for the first three weld layers and a 350 °F maximum interpass temperature for the remaining weld passes. Code Case N-638-1, Section 2.1(e) states that the maximum interpass temperature for the first three layers of the test assembly shall be 150 °F. Code Case N-638-1, Section 3.0(d) states that the maximum interpass temperature for field applications shall be 350 °F regardless of the interpass temperature during qualification. Although the interpass temperature limit in the licensee's alternative does not meet the requirements of QW-256, it is however consistent with NRC endorsed Code Case 638-1 and is therefore acceptable.

The licensee's alternative includes the use of Alloy 52/52M weld filler material. Alloy 52/52M is currently listed in ASME Code Section II, Part D and is acceptable for use in fabrication and repairs performed in accordance with ASME Code Sections III and XI. In addition, Alloy 52/52M has been used at several nuclear power plants to make numerous successful dissimilar metal welds to pressure boundary components such as the RVCH and pressurizer. Given the number of successful repairs and the inclusion of this material in ASME Code, the NRC staff finds the licensee's use of Alloy 52/52M weld metal acceptable.

The licensee's alternative to the requirements in NB-4622 is based on NRC endorsed Code Case N-638-1 with some differences which are discussed below. The licensee's alternative utilizes ambient temperature temper bead technique using GTAW. The licensee's alternative does not require preheat, PWHT or post weld bake out as part of the welding technique.

Code Case N-638-1, Section 2.1(b) requires consideration be given to the effects of welding in a pressurized environment. The NRC staff agrees with the licensee that this requirement is not applicable because the welding will not occur in a pressurized environment.

Code Case N-638-1, Section 2.1(c) requires consideration be given to the effects of irradiation on the properties of materials in the reactor vessel belt line region. The NRC staff agrees with the licensee that this requirement is not applicable because the welding will be performed on the RVCH, not in the reactor vessel belt line region.

Code Case N-638-1, Section 2.1(h) specifies Charpy V-notch requirements for ferritic weld material of the procedure qualification. The filler material used in the licensee's alternative is F-No. 43. F-No. 43 filler material is not ferritic. Consistent with ASME Code filler metal requirements, nickel based filler materials do not require Charpy V notch testing. The NRC staff agrees with the licensee that this requirement does not apply.

Code Case N-638-1, Section 2.1(j) requires Charpy V-notch tests of the ferritic HAZ. The licensee's current request does not follow Code Case N-638-1, Section 2.1(j). Code Case N-638-1, Section 2.1(j) requires the three HAZ impact tests be equal or greater than the unaffected base material tests. During the Charpy impact testing portion of the qualification process, the reference temperature (RT_{NDT}) was determined to be -30 °F. At RT_{NDT} +60 °F temperature (+30 °F), the average of the HAZ absorbed energy Charpy impact tests was greater than the average of the unaffected base material which is acceptable per the Code Case. However, the average of the mils lateral expansion for the HAZ was less than the average values for the unaffected base material. The licensee stated that additional Charpy V-notch tests were conducted on the HAZ material as permitted by NB-4335.2 to determine an additive temperature to the RT_{NDT} temperature. The average mils lateral expansion for the HAZ

at +35 °F was equivalent to the unaffected base material at +30 °F. As a result, the licensee performed the required adjustment temperature of +5 °F to the RT_{NDT} temperature for base material on which welding is performed. The NRC staff finds the proposed alternative acceptable because it meets the construction code requirements of NB-4335.2.

Code Case N-638-1, Section 3.0(c) requires the deposition and removal of a reinforcement layer when performing repair welds on similar (ferritic) materials. Repair welds on dissimilar materials are exempt from the removal of the reinforcement. Non-ferritic filler metals, such as, the F-No. 43 filler metal do not undergo a phase change at elevated temperature, and therefore do not require a post-weld heat treatment. Since the last layer of weld metal is a non-ferritic metal being deposited over previous non-ferritic weld filler metal layers, the need for a tempering layer and its removal is unnecessary. Therefore, the NRC staff finds that the deletion of this requirement is acceptable.

Code Case N-638-1, Section 3.0(e) requires care be taken to ensure that the weld region is free of all potential sources of hydrogen. The proposed welding procedure is inherently free of hydrogen; therefore, the NRC staff finds this requirement is satisfied.

Code Case N-638-1, Section 4.0(b) requires surface and ultrasonic examinations of the final weld surface and band around the weld area. However, the licensee stated that the band around the weld area cannot be examined due to the physical configuration of the partial penetration weld and interference from adjacent nozzles. The final UT and surface examination of the new weld and immediate surrounding area within the bore will be based on Figures 5 and 11 in Attachment 2 to Enclosure 1 of the September 15, 2006, submittal. The UT will be performed by scanning from the inner diameter surface of the weld. The examination area identified by the licensee is sufficient to facilitate the detection of unacceptable weld flaws that have been induced in the low alloy steel RVCH material as a result of the welding process and will assure integrity of the nozzle and the new weld. The NRC staff therefore finds the licensee's alternative acceptable.

Code Case N-638-1, Section 4.0(c) requires areas which had attached thermocouples to be ground and examined using a surface examination. The licensee stated that this requirement will be met if thermocouples are used. The NRC staff finds the proposed alternative acceptable because the licensee will satisfy this requirement if thermocouples are used.

Code Case N-638-1, Section 4.0(e) requires UT acceptance criteria to be in accordance with IWB-3000. The proposed welding technique requires UT acceptance criteria in accordance with NB-5330, which is consistent with the original construction code requirements. The licensee contends that for the configuration of the repair weld, IWB-3000 does not directly apply and therefore NB-5330 is appropriate. Construction Code criteria are generally more restrictive than Section XI standards because the NB-5330 standards do not permit many common welding flaws such as lack of fusion, incomplete penetration, or cracks, regardless of length. Section XI, IWB-3000 standards allow acceptance of these types of fabrication indications based on dimensioned flaw boundaries. Based on the licensee's alternative to use a more restrictive acceptance standard, the NRC staff finds the proposed alternative acceptable.

As a result of the proposed nozzle repair, a region/space in the RVCH penetration between the original nozzle and replacement nozzle will be exposed to the primary coolant. The licensee evaluated the RVCH base metal for potential general corrosion, galvanic corrosion, crevice

corrosion, stress corrosion cracking and hydrogen embrittlement. Galvanic corrosion, crevice corrosion, stress corrosion cracking, and hydrogen embrittlement of the RVCH are not significant concerns based on operational experience with low alloy steel exposed to primary coolant. The general corrosion rate for the RVCH, under the anticipated exposure conditions, is 0.0032 inches/year. This corrosion rate is based on an 18-month operating cycle followed by a 2-month refueling cycle. The NRC staff finds this corrosion rate is low and will not affect the structural integrity of the RVCH.

5.0 CONCLUSION

On the basis of the NRC staff's evaluation, the NRC staff concludes that the licensee's proposed alternatives to flaw repair and inspection for the CRD nozzles and ICI nozzles of the RVCH provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR, Section 50.55a(a)(3)(i), the NRC staff authorizes Relief Request No. 1, for the repair of the CRD nozzles and ICI nozzles of the RVCH through the end of the fourth 10-year inservice inspection interval .

All other requirements of the ASME Code, Sections III, IX and XI, for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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