NMC
Committed to Nuclear Excellence

PALISADES NUCLEAR PLANT
Operated by Nuclear Management Company, LLC

August 2, 2004 10 CFR 50.55a

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Request for Relief from ASME Section XI Code Requirements for Repair of Reactor Pressure Vessel Head Penetrations

Nuclear Management Company, LLC (NMC) is performing ultrasonic examinations of the reactor vessel closure head (RVCH), control rod drive (CRD), and incore instrumentation (ICI) nozzle penetrations during the upcoming refueling outage at the Palisades Nuclear Plant, in accordance with 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. NMC requires the enclosed relief requests in the event a RVCH penetration is in need of a repair at Palisades. Therefore, NMC requests relief from certain sections of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, 1989 Edition, as described in the attached Enclosures.

Enclosure 1 requests relief from the ASME Code, Section XI, IWA-4120, "Rules and Requirements." NMC proposes an alternative to the specified code requirements in accordance with 10 CFR 50.55a(a)(3)(i). The basis for the relief is provided, describing that the alternative provides an acceptable level of quality and safety.

Enclosure 2 requests relief from the ASME Code, Section XI, IWA-3300, "Flaw Characterization," IWB-3142.4, "Acceptance by Analytical Evaluation," and IWB-3420, "Characterization." NMC proposes an alternative to the specified code requirements in accordance with 10 CFR 50.55a(a)(3)(i). The basis for the relief is provided, describing that the alternative provides an acceptable level of quality and safety.

NMC will implement a Framatome Advanced Nuclear Products (FANP) design repair, for the Palisades Nuclear Plant, if a RVCH penetration repair is necessary. FANP performed the detailed analyses to justify this repair technique at Palisades Nuclear Plant. NMC has reviewed and approved these analyses. The analyses that support the relief requests are included as Attachments to the Enclosures. The analyses are as follows:

A047

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Attachment 2 to Enclosure 1 - AREVA Document 32-5043862-00, "Palisades CRDM Nozzle IDTB Weld Anomaly Flaw Evaluations," dated July 2004 (Proprietary)

Attachment 3 to Enclosure 1 - AREVA Document 32-5045260-00, "Palisades ICI Nozzle IDTB Weld Anomaly Flaw Evaluations," dated July 2004 (Proprietary)

Attachment 1 to Enclosure 2 - AREVA Document 32-5044161-00, "Palisades CRDM Nozzle IDTB J-Groove Weld Flaw Evaluation," dated July 2004 (Proprietary)

Attachment 2 to Enclosure 2 - AREVA Document 32-5045743-00, "Palisades ICI Nozzle IDTB Weld Flaw Evaluation," dated July 2004 (Proprietary)

NMC has reviewed the Nuclear Regulatory Commission Regulatory Issue Summary 2004-11, "Supporting Information Associated With Requests For Withholding Proprietary Information," dated June 29, 2004. The attached AREVA Proprietary documents are marked according to the requirements set forth in 10 CFR 2.390.

A FANP proprietary authorization affidavit supporting the above calculations is included with the AREVA documents. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in 10 CFR 2.390.

NMC requests that the above Attachments, which are proprietary to FANP, be withheld from public disclosure in accordance with 10 CFR 2.390. Correspondence regarding the proprietary aspects of the items listed above, or the supporting FANP affidavit, should reference the affidavit and be addressed the J.F. Mallay, Director Regulatory Affairs, Framatome ANP, Inc., 3315 Forest Road, P.O. Box 10935, Lynchburg, Virginia, 24506-0935.

Relief is requested for the remainder of the current ten-year inspection interval, which will conclude on or before December 12, 2006.

NMC requests approval of the proposed relief requests by October 1, 2004, to support Palisades Nuclear Plant's upcoming refueling outage.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

Daniel J. Malone
Site Vice President, Palisades Nuclear Plant
Nuclear Management Company, LLC

Enclosures (2)
Attachments (5)

cc: (with Enclosures and Attachments)
Project Manager, Palisades, USNRC

cc: (with Enclosures without Attachments)
Administrator, Region III, USNRC
Resident Inspector, Palisades, USNRC

ASME Code Component Affected

The affected components are the Palisades Nuclear Plant reactor vessel closure head (RVCH), control rod drive (CRD), and incore instrumentation (ICI) nozzle penetrations. The Palisades Nuclear Plant has 45 CRD penetrations and eight ICI penetrations, which are American Society of Mechanical Engineers (ASME) Class 1 penetrations.

Applicable Code Edition and Addenda

The applicable code edition and addenda for the RVCH penetration repair is the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI, 1989 Edition with no addenda. Palisades is currently in the third ten-year inservice inspection interval.

Applicable Code Requirement

The applicable code requirement for the RVCH penetration repair is ASME Section XI, IWA-4120, "Rules and Requirements," as follows:

(a) Repairs shall be performed in accordance with the owner's design specification and the original construction code of the component or system. Later edition and addenda of the construction code or of Section III, either in their entirety or portions thereof, and code cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements, of IWA-4500 and the following may be used:
   (1) IWB-4000 for Class 1 components;
   (2) IWC-4000 for Class 2 components;
   (3) IWD-4000 for Class 3 components;
   (4) IWE-4000 for Class MC components; or
   (5) IWF-4000 for component supports.

(b) The edition and addenda of Section XI used for the repair program shall correspond with the edition and addenda identified in the inservice inspection program applicable to the inspection interval.

(c) Later editions and addenda of Section XI, either in their entirety or portions thereof, may be used for the repair program, provided these editions and addenda of Section XI at the time of the planned repair have been incorporated by reference in amended regulations of the regulatory authority having jurisdiction at the plant site.

The original construction code for the Palisades Nuclear Plant RVCH is ASME Section III, 1965 Edition, including addenda through winter 1965.

The proposed repairs will be conducted in accordance with the 1989 Edition of ASME Section XI, no addenda, the 1989 Edition of ASME Section III, no addenda, and the alternative requirements discussed below.

Reason for Request

Nuclear Management Company, LLC (NMC) is requesting relief from ASME Section XI, 1989 Edition, IWA-4120, pursuant to 10 CFR 50.55a(a)(3)(i), because the alternative provides an acceptable level of quality and safety.

For the proposed repairs to the RVCH penetrations, paragraph N-528.2 of the 1965 Edition of Section III, including addenda through winter 1965, requires repairs be postweld heat treated (PWHT) in accordance with paragraph N-532. The PWHT requirements set forth therein are not practical to attain on a RVCH. In addition to possible distortion of the RVCH, significant personnel dose would be expended to set up and remove the PWHT equipment.

Proposed Alternative and Basis for Use

NMC requests relief to use an ambient temperature temper bead method of repair as an alternative to the requirements of the 1989 Edition of ASME Section III, NB-4453, NB-4622, NB-5245, and NB-5330. Approval is requested to use filler material, Alloy 52 AWS 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, "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 13, have also been used as a template for this application. As an alternative to these code case requirements, the requirements of Attachment 1, "Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," will be used.

Because of the risk of damage to the RVCH material properties or dimensions and the additional dose that would be required, it is not feasible to apply the PWHT requirements of paragraph NB-4622 of the 1989 ASME Section III Code to the RVCH or the elevated temperature preheat and post weld soak required by the alternative temper bead method offered by ASME Section XI IWA-4500. Therefore, pursuant to 10 CFR 50.55a (a)(3)(i), NMC requests relief to use an ambient temperature temper bead welding method of repair as an alternative to the requirements of the 1989 Edition, no addenda, of ASME Section III, NB-4622.

Repairs to the RVCH, CRD, and ICI nozzle penetration J-groove attachment welds, which are required when ⅛-inch or less of non-ferritic weld deposit exists above the original fusion line, will be made in accordance with the requirements of IWA-4000, of the 1989 Edition of ASME Section XI. The requirements of paragraphs NB-4622, NB-3300, and NB-5245, of the 1989 Edition of ASME Section III, and QW-256 of the 1989 Edition of ASME Section XI are also applicable to the potential repairs. Applicable alternatives to these requirements will be used per the requirements of Attachment 1. Specifically, alternatives are being proposed for the following ASME Section III, Section IX, and Section XI requirements:

1. NB-4622.1 establishes the requirement for PWHT of welds including repair welds. In lieu of these requirements, NMC proposes to utilize a temper bead weld procedure, which would preclude the need for PWHT.

2. NB-4622.2 establishes requirements for time at temperature recording of the PWHT and their availability for review by the inspector. This does not apply because the proposed alternative does not involve PWHT.

3. NB-4622.3 addresses the definition of nominal thickness as it pertains to time at temperature for PWHT. This is not applicable because the proposed alternative involves no PWHT.

4. NB-4622.4 establishes the holding times at temperature for PWHT. This is not applicable because the proposed alternative involves no PWHT.

5. NB-4622.5 establishes PWHT requirements when different P-number materials are joined. This is not applicable because the proposed alternative involves no PWHT.

6. NB-4622.6 establishes PWHT requirements for nonpressure retaining parts. This is not applicable because the potential repairs in question will be to pressure retaining parts. Furthermore, the proposed alternative involves no PWHT.

7. NB-4622.7 establishes exemptions from mandatory PWHT requirements. NB- 4622.7 (a) through NB-4622.7 (f) are not applicable in this case because they pertain to conditions that do not exist for the proposed repairs. NB-4622.7 (g) addresses exemptions to weld repairs to dissimilar metal welds if the requirements of subparagraph NB-4622.11 are met. This does not apply because the ambient temperature temper bead repair is being proposed as an alternative to the requirements of NB-4622.11.

8. NB-4622.8 establishes exemptions from PWHT for nozzle to component welds and branch connections to run piping welds. NB- 4622.8(a) establishes criteria for exemption of PWHT for partial penetration welds. This is not applicable to the proposed repairs because the criteria involve buttering layers at least ¼- inch thick, which will not exist for the welds in question. NB- 4622.8(b) also does not apply because it addresses full penetration welds and the welds in question are partial penetration welds.

9. 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. This does not apply because the proposed repairs will involve F-No. 43 filler metals.

10. NB-4622.10 establishes requirements for repair welding to cladding after PWHT. This does not apply because the proposed repair alternative does not involve repairs to cladding.

11. NB-4622.11 addresses temper bead weld repair to dissimilar metal welds or buttering and would apply to the proposed repairs as follows:

    A. NB-4622.11 (a) requires surface examination prior to repair in accordance with NB-5000. The proposed alternative will include surface examination prior to repair consistent with NB-5000.

    B. NB-4622.11 (b) contains requirements for the maximum extent of repair including a requirement that the depth of excavation for defect removal not exceed ⅜-inch in the base metal. The proposed alternative will include the same limitations on the maximum extent of repair.

    C. NB-4622.11 (c) addresses the repair welding procedure and welder qualification in accordance with ASME Section IX and the additional requirements of Article NB-4000. The proposed alternative will satisfy these requirements, except for the stipulations of paragraph QW-256 of Section IX, as explained in the justification of relief section below. In addition, NB-4622.11 (c) requires that the welding procedure specification include the following requirements:

        1) 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 proposed alternative will satisfy this requirement.

        2) NB-4622.11 (c)(2) requires the use of the shielded metal arc welding (SMAW) process with covered electrodes meeting either the A-No. 8 or F-No. 43 classifications. The proposed alternative uses GTAW with bare electrodes and bare filler metal meeting the F-No. 43 classification.

3) NB-4622.11 (c)(3) addresses requirements for covered electrodes pertaining to hermetically sealed containers or storage in heated ovens. These requirements do not apply because the proposed alternative uses bare electrodes and bare filler metal that do not require storage in heated ovens because neither bare electrodes nor bare filler metal will pick up moisture from the atmosphere as covered electrodes may.

4) NB-4622.11 (c)(4) addresses requirements for storage of covered electrodes during repair welding. These requirements do not apply because the proposed alternative utilizes bare electrodes and bare filler metal, which do not require any special storage conditions to prevent the pick up of moisture from the atmosphere.

5) NB-4622.11 (c)(5) requires preheat of the weld area and 1½ times the component thickness or five-inch band, whichever is less, to a minimum temperature of 350°F prior to and during repair welding, and a maximum interpass temperature of 450°F. Thermocouples and recording instruments shall be used to monitor the metal temperature during welding. The proposed ambient temperature temper bead alternative does not require an elevated temperature preheat. Interpass temperature measurements cannot be accomplished due to inaccessibility in the weld region. Therefore, the maximum interpass temperature will be determined by calculation as shown in the "Justification of Relief" section below.

6) 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. Because the proposed alternative uses machine GTAW, the requirement to remove the weld crown of the first layer is unnecessary and the proposed alternative does not include the requirement.

7) NB-4622.11 (c)(7) requires the preheated area to be heated from 450°F to 660°F for four hours after a minimum of 3/16-inch of weld metal has been deposited. The proposed alternative does not require this heat treatment because the use of the extremely low hydrogen GTAW temper bead procedure does not require the hydrogen bake out.

8) NB-4622.11 (c)(8) requires welding subsequent to the hydrogen bake out of 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 (maximum) and requires the area to be welded be at least 50°F prior to welding. This approach has been demonstrated to be adequate to produce sound welds.

12. NB-4622.11 (d)(1) requires a liquid penetrant examination after the hydrogen bake out described in NB-4622.11 (c)(7). The proposed alternative does not require the hydrogen bake out because it is unnecessary for the extremely low hydrogen GTAW temper bead process.

13. NB-4622.11 (d)(2) requires liquid penetrant and radiographic examinations of the repair welds and the preheated band after a minimum time of 48 hours at ambient temperature. Ultrasonic inspection is required if practical. The proposed alternative includes the requirement to inspect after a minimum of 48 hours at ambient temperature. Because the proposed repair welds are of a configuration that cannot be radiographed (due to limitations on access for source and film placement and the likelihood of unacceptable geometric unsharpness and film density), the proposed alternative final inspection will be by liquid penetrant and ultrasonic examination.

14. 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. In lieu of the progressive liquid penetrant examination, the proposed alternative will use liquid penetrant and ultrasonic examination of the final weld. The volumetric examination coupled with surface examination will provide a high level of confidence that the proposed welds are sound.

15. NB-4622.11 (e) establishes the requirements for documentation of the weld repairs in accordance with NB-4130. The proposed alternative will comply with the requirement.

16. NB-4622.11 (f) establishes requirements for the procedure qualification test plate. The proposed alternative complies with these requirements.

17. 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 pertinent to the SMAW manual welding process. The proposed alternative involves a machine GTAW process and requires welding operators be qualified in accordance with ASME Section IX. The use of a machine process eliminates any concern about obstructions, which might interfere with the welder's abilities, because all such obstructions will have to be eliminated to accommodate the welding machine.

18. NB-4453.4 of Section III requires examination of the repair weld in accordance with the requirements for the original weld. The welds being made in accordance with the proposed alternatives will be partial penetration welds as described by NB- 4244(d) and will meet the weld design requirements of NB-3352.4 (d). For these partial penetration welds, paragraph NB-5245 requires a progressive surface exam (liquid penetrate (PT) or magnetic particle (MT)) at the lesser of one-half the

maximum weld thickness or ½-inch, as well as on the finished weld. For the proposed alternative, the repair weld will be examined by a liquid penetrant and ultrasonic examination no sooner than 48 hours after the weld has cooled to ambient temperature in lieu of the progressive surface exams required by NB-5245. The volumetric examination coupled with surface examination will provide a high level of confidence that the proposed welds are sound.

19. NB-5330 (b) does not allow any cracks or incomplete penetration regardless of length. As a result of the welding process, a linear indication often occurs 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 justification of relief section below discusses this in further detail.

20. QW-256, of ASME Section IX, requires that the maximum interpass temperature during procedure qualification be no more than 100°F below that used for actual welding. Per Attachment 1, the maximum interpass temperature during welding is specified to be 350°F maximum. The maximum interpass temperature during the procedure qualification was less than 100°F. The justification of relief section below (part six) discusses this in further detail.

Justification of Relief

The alternative to the NB-4622 requirements being proposed involves the use of an ambient temperature temper bead welding technique that avoids the necessity of traditional PWHT, preheat and postweld heat soaks. The welding technique described in Attachment 1 is similar to the requirements of Code Case N-638. The proposed welding technique differs from that described in sections 1.0 through 4.0 of Code Case N-638 as follows:

a) N-638 2.1 (b) requires consideration be given to the effects of welding in a pressurized environment. This requirement is not applicable because the welding will not occur in a pressurized environment.

b) N-638 2.1 (c) requires consideration be given to the effects of irradiation on the properties of materials in the core belt line region. This requirement is not applicable because the welding will be on the RVCH, not in the belt line region.

c) N-638 2.1 (h) specifies Charpy V notch requirements for ferritic weld material of the procedure qualification. The filler material is F-No. 43, which is not ferritic. Therefore this requirement does not apply.

d) N-638 3.0 (c) requires a layer of weld reinforcement be applied and then machined to a flush surface. This requirement is not applicable because the welding will join dissimilar metals with non-ferritic weld filler metal.

e) N-638 3.0 (d) specifies the maximum interpass temperature for field applications shall be 350°F regardless of the interpass temperature during qualification. N-638 2.1 (e) specifies the maximum interpass temperature for the first three layers of the test assembly shall be 150°F. QW-256 specifies maximum interpass temperature as a supplementary essential variable that must be held within 100 °F above that used during procedure qualification. See part six below for variation to the requirements of QW-256.

f) N-638 3.0 (e) requires care be taken to ensure that the weld region is free of all potential sources of hydrogen. As described below, the proposed alternative temper bead procedure utilizes a welding process that is inherently free of hydrogen.

g) N-638 4.0(b) requires the final weld surface and band around the area defined in paragraph 1.0 (d) to be examined using surface and ultrasonic (UT) methods. The purpose for the examination of the band is to assure all flaws associated with the weld repair area have been removed or addressed. However, the band around the area defined in paragraph 1.0(d) cannot be examined due to the physical configuration of the partial penetration weld. The final examination of the new weld and immediate surrounding area within the bore will be sufficient to verify that defects have not been induced in the low alloy steel RVCH material due to the welding process. Figures 3 and 4 indicate the area for PT and UT for the CRD and ICI penetration repairs. UT will be performed by scanning from the inner diameter (ID) surface of the weld. The UT is qualified to detect flaws in the repair weld and base metal interface in the repair region, to the maximum practical extent. UT acceptance criteria will be in accordance with NB-5330. The extent of the examination is consistent with the construction code requirements.

h) N-638 4.0 (c) requires areas which had weld-attached thermocouples attached to be ground and examined using a surface examination. This requirement will be met if thermocouples are used.

i) N-638 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 features of the alternative repair technique that make it applicable and acceptable for the potential repairs are described below:

1) The proposed alternative will require the use of an automatic or machine GTAW temper bead technique without the specified preheat or postweld heat treatment of the Construction Code. The proposed alternative will include the requirements of paragraphs 1.0 through 5.0 of Attachment 1. The alternative will be used to make welds of P-No. 3 (RVCH material) to P-No. 43 (CRD and ICI nozzle material) using F-No. 43 filler material.

2) The use of a GTAW ambient temperature temper bead welding technique to avoid the need for postweld heat treatment is based on research that has been performed by Electric Power Research Institute (EPRI) (EPRI Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temperbead Applications," dated November 1998). The research demonstrates that carefully controlled heat input and bead placement allow subsequent welding passes to relieve stress and temper the heat affected zone (HAZ) of the base material and preceding weld passes. Data presented in Tables 4-1 and 4-2 of the report show the results of procedure qualifications performed with 300°F preheats and 500°F post-heats, as well as with no preheat and post-heat. From that data, it is clear that equivalent toughness is achieved in base metal and HAZ in both cases. The ambient temperature temper bead process has been shown effective by research, successful procedure qualifications, and many successful repairs performed since the technique was developed.

3) The NB-4622.11 (c)(2) temper bead procedure requires the use of the SMAW welding process with covered electrodes. Even the low hydrogen electrodes, which are required by NB-4622, may be a source of hydrogen unless very stringent electrode baking and storage procedures are followed. The only shielding of the molten weld puddle and surrounding metal from moisture in the atmosphere (a source of hydrogen) is the evolution of gases from the flux and the slag that forms from the flux and covers the molten weld metal. As a consequence of the possibility for contamination of the weld with hydrogen, NB-4622 temper bead procedures require preheat and postweld hydrogen bake-out. However, the proposed alternative temper bead procedure utilizes a welding process that is inherently free of hydrogen.

4) Final examination of the repair welds would be by PT and UT and would not be conducted until at least 48 hours after the weld had returned to ambient temperature following the completion of welding. Given the ⅜-inch limit on repair depth in the ferritic material, the delay before final examination would provide ample time for any hydrogen that did inadvertently dissolve in the ferritic material to diffuse into the atmosphere or into the non-ferritic weld material, which has a higher solubility for hydrogen and is much less prone to hydrogen embrittlement cracking. Thus, in the unlikely event that hydrogen induced cracking did occur, it would be detected by the 48-hour delay in examination.

5) Results of procedure qualification work undertaken to date indicate that the ambient temper bead process produces sound and tough welds. Typical tensile test results have been ductile breaks in the weld metal.

6) The P-No. 43 to P-No. 3 welding procedure specifies a maximum interpass temperature of 350°F. The welding procedure was qualified with an interpass temperature less than 100°F. Per QW-256, of ASME Section IX, an increase greater than 100°F is a supplementary essential variable. The procedure qualification requirements recommended in Code Case N-638 impose an 150°F maximum interpass temperature during the welding of the procedure qualification. This requirement restricts base metal heating during qualification that could produce slower cooling rates that are not achievable during field applications. However, this requirement does not apply to field applications, as a 350°F maximum interpass temperature is a requirement in Section 3.0 of Code Case N-638. The higher interpass temperature is permitted because it would only result in slower cooling rates which could be helpful in producing more ductile transformation products in the HAZ.

Framatome Advanced Nuclear Products (FANP) has qualified the Machine GTAW of P-No. 3, low alloy steel base materials, to P-No. 43, nickel alloy base materials, with the ambient temperature temper bead weld technique in accordance with the rules of ASME Code Case N-638. The qualifications were performed on the same P-No. 3, Group No. 3 base material as proposed for the CRD and ICI penetration repairs, using the same filler material (i.e. Alloy 52 AWS Class ERNiCrFe-7) with similar low heat input controls as will be used in the repairs. Also, the qualifications did not include a post weld heat soak. Based on FANP prior welding procedure qualification test data using machine GTAW ambient temperature temper bead welding, quality temper bead welds can be achieved with 50°F minimum preheat and no post weld heat soak.

7) As discussed previously, NB-5245 requires progressive surface examination of the proposed partial penetration welds while the alternative requires final PT and UT, which will provide added assurance of sound welds. The original Construction Code required progressive PT in lieu of volumetric examination because volumetric examination is not practical for the conventional partial penetration weld configurations. In this case the weld is suitable for UT and a final PT can be performed. The final examination of the new weld repair and immediate surrounding area within the band will be sufficient to verify that defects have not been induced in the low alloy steel RVCH material due to the welding process. Figures 3 and 4 indicate the area for PT and UT for the CRD and ICI nozzle penetration repairs. UT will be performed by scanning from the ID surface of the weld. The UT is qualified to detect flaws in the repair weld and base metal interface in the repair region, to the maximum practical extent. UT acceptance criteria will be in accordance with NB-5330 (with exception to NB-3330 (b) for the triple point anomaly). The extent of examination is consistent with the construction code requirements.

8) The RVCH preheat temperature will be essentially the same as the reactor building ambient temperature. Therefore, RVCH preheat temperature monitoring in the weld region and the use of thermocouples is unnecessary and would result in additional personnel dose associated with thermocouple placement and removal. Consequently, preheat temperature verification by use of contact pyrometer on accessible areas of the RVCH is sufficient. In lieu of using thermocouples for interpass temperature measurements, calculations show that the maximum interpass temperature will never be exceeded based on a maximum allowable low welding heat input, weld bead placement, travel speed, and conservative preheat temperature assumptions. The calculation supports the conclusion that using the maximum heat input through the third layer of the weld, the interpass temperature returns to near ambient temperature. Heat input beyond the third layer will not have a metallurgical effect on the low alloy steel HAZ.

A welding mockup on the full size Midland RVCH, which is similar to the Palisades RVCH, was used to demonstrate the welding technique described herein. During the mockup, thermocouples were placed to monitor the temperature of the closure head during welding. Thermocouples were placed on the outside surface of the RVCH within a five-inch band surrounding the CRD nozzle. Three other thermocouples were placed on the RVCH inside surface. One of the three thermocouples was placed 1½ inches from the CRD nozzle penetration, on the lower hillside. The other inside surface thermocouples were placed at the edge of the five-inch band surrounding the CRD nozzle, one on the lower hillside, the second on the upper hillside. During the mockup, all thermocouples fluctuated less than 15°F throughout the welding cycle. Therefore, for ambient temperature conditions used for this repair, maintenance of the 350°F maximum interpass temperature will not be a concern.

9) UT will be performed in lieu of RT due to the repair weld configuration. Meaningful RT cannot be performed. The weld configuration and geometry of the penetration in the RVCH provide an obstruction for the x-ray path and interpretation would be very difficult. UT will be substituted for the RT and qualified to evaluate defects in the repair weld and at the base metal interface. This examination method is considered adequate and superior to RT for this geometry. The new structural weld is sized like a coaxial cylinder partial penetration weld. ASME Code Section III construction rules require progressive PT of partial penetration welds. The Section III original requirements for progressive PT were in lieu of volumetric examination. Volumetric examination is not practical for the conventional partial penetration weld configurations. In this case the weld is suitable for UT and a final surface PT will be performed.

10) The extent of PT examination is consistent with the construction code requirements. The final modification configuration and surrounding ferritic steel area affected by the welding is either inaccessible or extremely difficult to access. PT of the accessible ferritic steel bore will be performed after removal by boring of the lower end of the existing CRD nozzle prior to welding.

11) An artifact of the temper bead weld repair is an anomaly in the weld at the triple point. Fracture mechanics analyses were performed by FANP (AREVA Document 32-5043862-00,"Palisades CRDM Nozzle IDTB Weld Anomaly Flaw Evaluations," dated July 2004 (Proprietary), and AREVA Document 32-5045260-00, "Palisades ICI Nozzle IDTB Weld Anomaly Flaw Evaluations," dated July 2004 (Proprietary)) to evaluate a 0.100-inch semi-circular flaw extending 360 degrees around the circumference at the triple point locations where the Alloy 600 original nozzle or Alloy 690 replacement nozzle, the Alloy 52 weld, and the low alloy steel head meet. These analyses are provided as Attachments 2 and 3. The flaw is assumed to propagate in each of the two directions on the uphill and downhill sides of the nozzle. Flaw acceptance is based on the 1989 ASME Code Section XI criteria for applied stress intensity (IWB-3612) and limit load (IWB-3642).

The results of the analyses for the CRD and ICI nozzles demonstrate that a 0.1-inch weld anomaly is acceptable for a 27-year design life of the ID temper bead weld repair for both the CRD and ICI nozzles.

12) The potential corrosion concerns of the RVCH low alloy steel include: general, galvanic, crevice, stress corrosion cracking (SCC), and hydrogen embrittlement. Galvanic corrosion, crevice corrosion, SCC, and hydrogen embrittlement of the RVCH low alloy steel are not significant concerns based on previous operational experience with low alloy steel exposed to primary coolant. The general corrosion rate for the RVCH low alloy steel, under the anticipated exposure conditions, is 0.0032 inches/year. This corrosion rate is based on an 18-month operating cycle followed by a two-month refueling cycle.

13) Detailed stress and fatigue analyses of the ID temper bead (TB) CRD/ICI nozzle weld repair were performed. The analysis demonstrated that the IDTB CRD/ICI weld repair design meets the stress and fatigue requirements set by ASME Code, Section III, 1989 Edition without addenda. The conservative fatigue analyses conclude that the fatigue usage factor for 27 years of operation is 0.73 for the CRD weld repair and 0.682 for the ICI weld repair.

The life expectancy of the IDTB CRD/ICI weld repair was also evaluated with respect to the PWSCC concerns of the remaining Alloy 600 CRD nozzle portion affected by the IDTB weld repair. The Alloy 690 replacement lower nozzle and Alloy 52 IDTB weld are not considered susceptible to PWSCC. If the IDTB weld repair is not abrasive water jet machining (AWJM) remediated, the life expectancy relative to PWSCC is conservatively estimated at 1.3 effective full power years (EFPY) for a CRD nozzle and 1.5 EFPY for an ICI nozzle. If AWJM is used, the life expectancy relative to PWSCC is conservatively estimated at 53 EFPY for CRD and ICI nozzles. Based on evaluations of fatigue crack growth into the low alloy steel head using ASME Section XI flaw acceptance standards for preventing non-ductile failure, a postulated radial crack in the Alloy 182 J-groove weld and butter would be acceptable for 27 years of operation for a CRD nozzle and five years of operation for an ICI nozzle, considering the following transient frequencies:

Transient	Cycles / 40 Years
Heatup and Cooldown	500
Normal Power Changes	2000
Fast Power Changes	2000
Plant Loading and Unloading	2000
Loss of Load	200
Loss of Flow	200
Safety Valve Operations	200
Leak Test	320

The results of the triple point flaw analyses demonstrate that a 0.100-inch weld anomaly is acceptable for 27 years of operation following the CRD/ICI nozzle IDTB weld repair, considering the same transient frequencies listed in the above table.

Significant design margins have been demonstrated for all flaw propagation paths considered in the analysis. Flaw acceptance is based on the 1989 ASME Code Section XI criteria for applied stress intensity factor (IWB-3612) and limit load (IWB-3642). Fatigue crack growth is minimal along each flaw propagation path with the maximum final flaw size being only 0.174 inches for the CRD nozzle and 0.191 inches for the ICI nozzle. The minimum fracture toughness margin is 3.58 for the CRD nozzle and 4.26 for the ICI nozzle, compared to the required margin of $\sqrt{10}$ per IWB-3612. The margin on limit load is 5.77 for the CRD nozzle and 5.56 for the ICI nozzle, compared to the required margin of 3.0 per IWB-3642.

Based on the information presented, and pursuant to 10 CFR 50.55a(a)(3)(i), NMC requests approval for the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

Duration of Proposed Alternative

NMC requests approval of the proposed alternative for the remainder of the third ten-year interval of the Inservice Inspection Program for Palisades Nuclear Plant, which will conclude on or before December 12, 2006.

Precedents

There have been several similar requests made over the past two years by various licensees (Saint Lucie, Millstone, Turkey Point). This request specifically cites the request made for the Combustion Engineering, Calvert Cliffs Nuclear Power Plant.

By letter dated February 7, 2002 (ADAMS Accession # ML020420128), as supplemented by letters dated December 18, 2002 (ADAMS Accession # ML023600286) and January 20, 2003 (ADAMS Accession # ML030230468), Constellation Nuclear submitted relief requests to use an alternative repair technique for the reactor vessel head, at the Calvert Cliffs Nuclear Power Plant, Units 1 and 2. Calvert Cliffs requested relief to use of a modified methodology of ASME, Section XI Code Case N-638. NMC is also requesting relief to utilize this same modified methodology of ASME, Section XI Code Case N-638, at the Palisades Nuclear Plant. A difference in design between Calvert Cliffs and the Palisades proposed repair is that Palisades replaces the lower nozzle extensions while Calvert Cliffs does not. The lower nozzles will be replaced to maintain Palisades design. The lower nozzle extensions are constructed of Alloy 690 material and are not susceptible to PWSCC.

NMC has reviewed the requests for additional information that Calvert Cliffs received on the relief request and has incorporated this information into this request. The NRC issued the safety evaluation on this relief request by letter dated August 29, 2003 (ADAMS Accession # ML032160511).

ATTACHMENT 1
RELIEF REQUEST #1: ALTERNATE REPAIR TECHNIQUE DISSIMILAR METAL WELDING USING AMBIENT TEMPERATURE MACHINE GTAW TEMPER BEAD TECHNIQUE

NMC plans to perform reactor vessel closure head (RVCH), control rod drive (CRD), and incore instrumentation (ICI) nozzle penetration repairs by welding the RVCH (P-No.3 base material) and the RVCH nozzle penetrations (P-No.43 base material) with filler material F-No.43, in accordance with the following:

1.0 General Requirements

(a) The maximum area of an individual weld based on the finished surface will be less than 100 square inches, and the depth of the weld will not be greater than one-half of the ferritic base metal thickness.

(b) Repair/replacement activities on a dissimilar-metal weld are limited to those along the fusion line of a non-ferritic weld to ferritic base material on which ⅛-inch or less of non-ferritic weld deposit exists above the original fusion line.

(c) If a defect penetrates into the ferritic base material, repair of the base material, using a non-ferritic weld filler material, may be performed provided the depth of repair in the base material does not exceed ⅜ inches.

(d) Prior to welding, the area to be welded and a band around the area of at least 1½ times the component thickness (or five inches, whichever is less) will be at least 50°F.

(e) Welding materials will meet the owner's requirements and the construction code and cases specified in the repair/replacement plan. Welding materials will be controlled so that they are identified as acceptable until consumed.

(f) Peening will not be used, however, the weldment final surface will be abrasive water jet conditioned.

2.0 Welding Qualifications

The welding procedures and the welding operators shall be qualified in accordance with Section IX and the requirements of paragraphs 2.1 and 2.2.

2.1 Procedure Qualification

(a) The ferritic steel base material for the welding procedure qualification is P-No. 3 Group No.3, which is the same P-No. and Group No. as the low alloy steel closure head base material to be welded. The ferritic base material shall be postweld heat treated to at least the time and temperature that was applied to the materials being welded. The other base material is P-No. 43. The filler metal is F-No. 43.

(b) The root width and included angle of the cavity in the test assembly will be no greater than the minimum specified for the repair.

(c) The maximum interpass temperature for the first three layers of the test assembly will be 150°F.

(d) The ferritic steel P-No. 3 Group No.3 base material test assembly cavity depth will be at least one-half the depth of the weld to be installed during the repair/replacement activity, and at least one-inch. The test assembly thickness will be at least twice the test assembly cavity depth. The test assembly will be large enough to permit removal of the required test specimens. The test assembly dimensions surrounding the cavity will be at least the test assembly thickness, and at least six inches. The qualification test plate will be prepared in accordance with Figure 1.

(e) Ferritic base material for the procedure qualification test will meet the impact test requirements of the construction code and owner's requirements. If such requirements are not in the construction code and owner's requirements, the impact properties shall be determined by Charpy V-notch impact tests of the procedure qualification base material, at or below the lowest service temperature of the item to be repaired. The location and orientation of the test specimens shall be similar to those required in subparagraph (f) below, but shall be in the base metal.

(f) Charpy V-notch tests of the ferritic heat-affected zone (HAZ) will be performed at the same temperature as the base metal test of subparagraph (e) above. Number, location, and orientation of test specimens will be as follows:

1. The specimens will be removed from a location as near as practical to a depth of one-half the thickness of the deposited weld metal. The test coupons for heat affected zone (HAZ) impact specimens will be taken transverse to the axis of the weld and etched to define the HAZ. The notch of the Charpy V-notch specimens will be cut approximately normal to the material surface in such a manner as to include as much HAZ as possible in the resulting fracture. When the material thickness permits, the axis of a specimen will be inclined to allow the root of the notch to be aligned parallel to the fusion line.

2. If the test material is in the form of a plate or a forging, the axis of the weld will be oriented parallel to the principal direction of rolling or forging.

3. The Charpy V-notch test will be performed in accordance with SA-370. Specimens will be in accordance with SA-370, Figure 11, Type A. The test will consist of a set of three full-sized 10-mm x 10-mm specimens. The lateral expansion, percent shear, absorbed energy, test temperature, orientation and location of all test specimens will be reported in the Procedure Qualification Record.

(g) The average values of the three HAZ impact tests shall be equal to or greater than the average values of the three unaffected base material tests.

2.2 Performance Qualification

Welding operators will be qualified in accordance with ASME Section IX.

3.0 Welding Procedure Requirements

The welding procedure shall include the following requirements:

(a) The weld metal will be deposited by machine gas tungsten arc welding (GTAW) process.

(b) Dissimilar metal welds shall be made using F-No. 43 weld metal (QW-432) for P-No. 43 to P-No. 3 weld joints.

(c) The ferritic steel area to be welded will be buttered with a deposit of at least three layers to achieve at least ⅛-inch overlay thickness as shown in Figure 2, steps 1 through 3, with the heat input for each layer controlled to within ±10% of that used in the procedure qualification test. Particular care will be taken in placement of the weld layers at the weld toe area of the ferritic material to ensure that the HAZ and ferritic weld metal are tempered. Subsequent layers will be deposited with a heat input not exceeding that used for layers beyond the third layer in the procedure qualification.

(d) The maximum interpass temperature for field applications will be 350°F regardless of the interpass temperature during qualification. The new weld is inaccessible for mounting thermocouples near the weld. Therefore, thermocouples will not be used to monitor interpass temperature. Preheat temperature will be monitored using contact pyrometer(s) and/or thermocouple(s), on accessible areas of the closure head external surface(s).

4.0 Examination

(a) Prior to welding, a surface examination will be performed on the area to be welded.

(b) Areas from which weld-attached thermocouples, if used, have been removed shall be ground and examined using a surface examination method.

(c) The final weld surface and adjacent HAZ shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours.

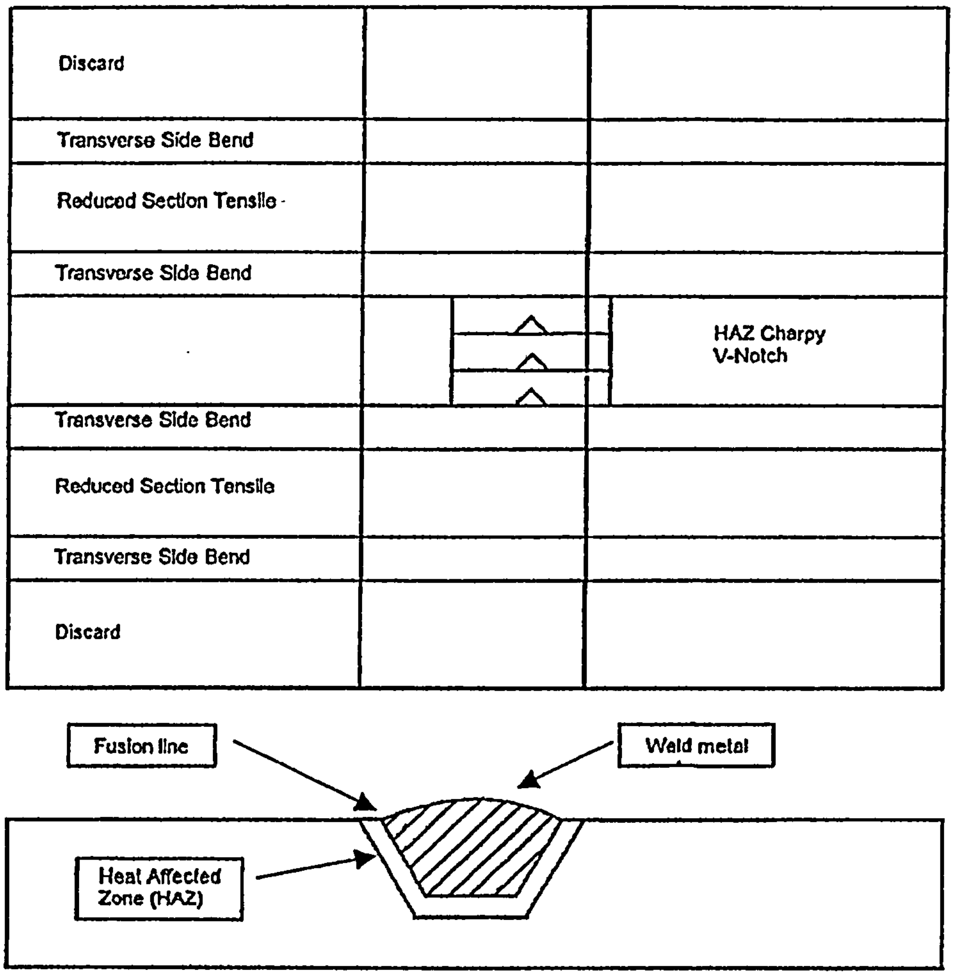
The purpose for the examination of the band is to assure all flaws associated with the weld repair area have been removed or addressed. However, the band around the area defined in paragraph 1.0(d) cannot be examined due to the physical configuration of the partial penetration weld. The final examination of the new weld repair and immediate surrounding area within the band will be sufficient to verify that defects have not been induced in the low alloy steel reactor vessel head material due to the welding process. Figures 3 and 4 indicate the area for liquid penetrant (PT) and ultrasonic (UT) examination for the CRD and ICI nozzle penetration repairs. UT will be performed by scanning from the inner diameter (ID) surface of the weld and adjacent portion of the CRD and ICI nozzle bore. The UT is qualified to detect flaws in the repair weld and base metal interface in the repair region, to the maximum practical extent. The examination extent is consistent with the construction code requirements.

(d) NDE personnel will be qualified in accordance with IWA-2300 or NB-5500.

(e) Surface examination acceptance criteria will be in accordance with NB-5350. Ultrasonic examination acceptance criteria will be in accordance with NB-5330.

5.0 Documentation

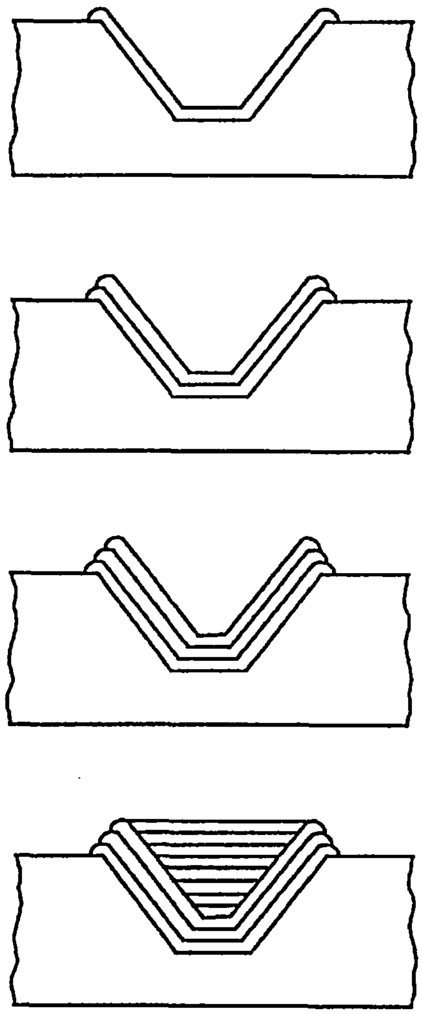
Repairs will be documented on Form NIS-2.



GENERAL NOTE: Base metal Charpy impact specimens are not shown. This figure illustrates a similar-metal weld.

QUALIFICATION TEST PLATE

Figure 1



Step 1: Deposit layer one with first layer weld parameters used in qualification.

Step 2: Deposit layer two with second layer weld parameters used in qualification. NOTE: Particular care shall be taken in application of the second layer at the weld toe to ensure that the weld metal and HAZ of the base metal are tempered.

Step 3: Deposit layer three with third layer weld parameters used in qualification. NOTE: Particular care shall be taken in application of the third layer at the weld toe to ensure that the weld metal and HAZ of the base metal are tempered.

Step 4: Subsequent layers to be deposited as qualified, with heat input less than or equal to that qualified in the test assembly. NOTE: Particular care shall be taken in application of the fill layers to preserve the temper of the weld metal and HAZ

GENERAL NOTE: The illustration above is for similar-metal welding using a ferritic filler material. For dissimilar-metal welding, only the ferritic base metal is required to be welded using steps 1 through 3 of the temperbead welding technique.

AUTOMATIC OR MACHINE (GTAW) TEMPERBEAD WELDING

Figure 2

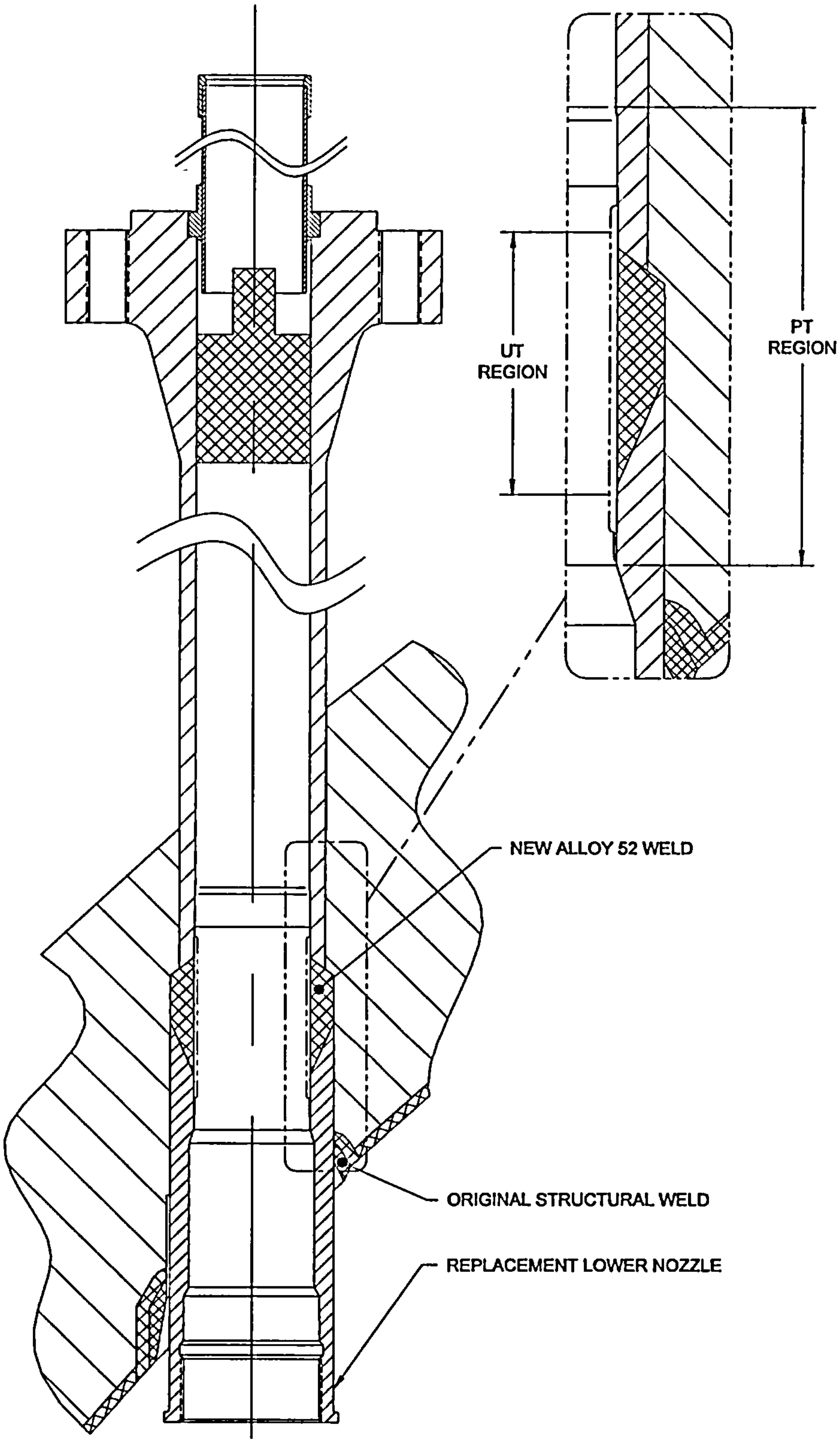


Figure 3
CRD Repair NDE

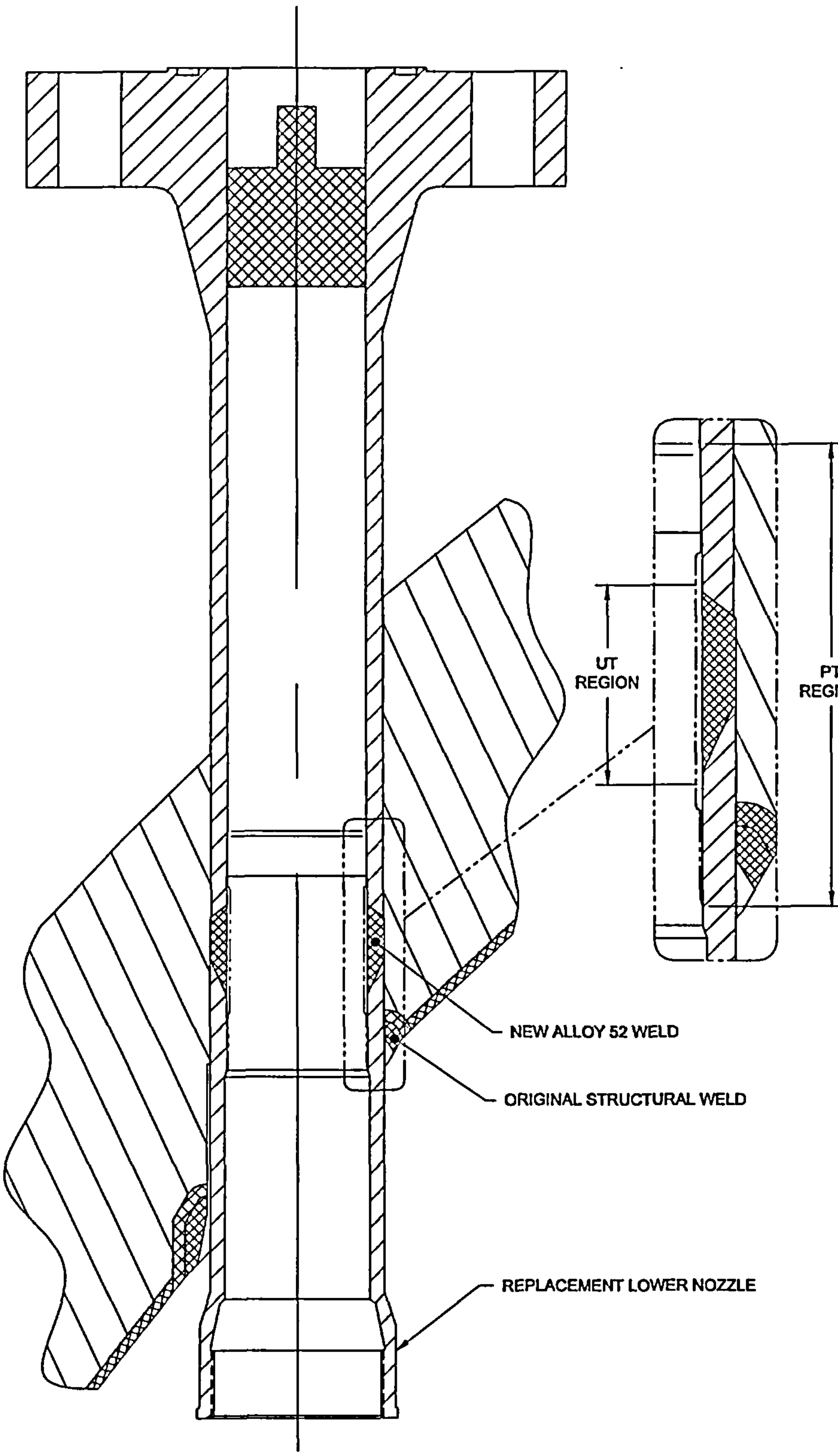


Figure 4
ICI Repair NDE

AFFIDAVIT

STATE OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Gayle F. Elliott. I am Manager, Product Licensing, for Framatome ANP ("FANP"), and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by FANP to determine whether certain FANP information is proprietary. I am familiar with the policies established by FANP to ensure the proper application of these criteria.

3. I am familiar with the FANP information contained in four calculations concerning flaw evaluations at Palisades (document identifiers 32-5043862-00, 32-5044161-00, 32-5045743-00, and 32-5045260-00). These documents are being sent to the NRC by NMC in support of certain relief requests. These four calculations are referred to herein as "Documents." Information contained in these Documents has been classified by FANP as proprietary in accordance with the policies established by FANP for the control and protection of proprietary and confidential information.

4. These Documents contain information of a proprietary and confidential nature and is of the type customarily held in confidence by FANP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in these Documents as proprietary and confidential.

5. These Documents have been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in these Documents be withheld from public disclosure.

6. The following criteria have been applied by FANP to determine whether information should be classified as proprietary:

(a) The information reveals details of FANP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FANP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FANP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by FANP, would be helpful to competitors to FANP, and would likely cause substantial harm to the competitive position of FANP.

7. These Documents meet the five criteria set forth in Paragraph 6 of this affidavit (namely, (a) through (e)). Specifically, the methodology contained in these Documents was developed at significant cost under FANP's research and development program and if copied by a competitor would allow the competitor to design and market a similar product while substantially reducing its expenditures. While there are several uses of generic equations in the calculations as well as the use of equations from the ASME Code, the overall approach and analytical techniques used in these Documents provide a competitive advantage for FANP because the exclusive use of this methodology permits FANP to hold a competitive advantage in the market. These Documents contain information concerning the details of the methodology

that would be helpful to FANP's competitors and would substantially degrade FANP's competitive position.

8. In accordance with FANP's policies governing the protection and control of information, proprietary information contained in these Documents has been made available, on a limited basis, to others outside FANP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

9. FANP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

10. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 4th
day of August, 2004.

Ella F. Carr-Payne
NOTARY PUBLIC, STATE OF VIRGINIA
MY COMMISSION EXPIRES: 8/31/05

ELLA F. CARR-PAYNE
Notary Public
Commonwealth of Virginia
My Commission Exps. Aug 31, 2005