October 2, 2002

Mr. J. A. Price
Site Vice President - Millstone
Dominion Nuclear Connecticut, Inc.
c/o Mr. David A. Smith
Rope Ferry Road
Waterford, CT, 06385

SUBJECT: SAFETY EVALUATION OF RELIEF REQUESTS RR-89-34 AND RR-89-36, REPAIR OF REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES, MILLSTONE POWER STATION, UNIT NO. 2 (TAC NO. MB4223)

Dear Mr. Price:

By letter dated February 25, 2002, as supplemented March 13, March 19, and March 21, 2002, you submitted Relief Requests RR-89-34, Revision 1, and RR-89-36 for Millstone Power Station, Unit No. 2 (MP2). Your submittal proposed alternatives to certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, 1989 Edition, for repair of reactor pressure vessel head penetration nozzles associated with the control element drive mechanisms. Specifically, you proposed to perform the weld repairs using alternative temper bead welding requirements and alternatives to ASME non-destructive examination and flaw evaluation requirements.

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of MP2 Relief Requests RR-89-34, Revision 1, and RR-89-36, and finds that complying with the ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, the proposed alternatives are authorized pursuant to Section 50.55a(a)(3)(ii) of Title 10 of the Code of Federal Regulations for the third 10-year inservice inspection interval.

In view of the immediate need during the past refueling outage, the staff chose to authorize the proposed alternatives in verbal form due to undue regulatory burden that would have resulted from the delay inherent in a written authorization. This verbal authorization was made at approximately 2:00 p.m. on March 22, 2002. The principal NRC staff members who participated in the telephone conversation with Mr. Ravi Joshi of your staff were:

Mr. Victor Nerses	Acting Chief, Section 2, Project Directorate I, Division of Licensing Project Management (DLPM)
Mr. Robert D. Starkey	Project Manager, Section 2, Project Directorate I, DLPM
Mr. Terence L. Chan	Chief, Materials Inspection Section, Materials and Chemical Engineering Branch, Division of Engineering

The enclosed Safety Evaluation documents the basis on which the staff verbally authorized the proposed alternatives on March 22, 2002.

Sincerely,

/RA/

James W. Andersen, Acting Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure: Safety Evaluation

cc w/encl: See next page

The enclosed Safety Evaluation documents the basis on which the staff verbally authorized the proposed alternatives on March 22, 2002.

Sincerely,

/RA/

James W. Andersen, Acting Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure: Safety Evaluation

cc w/encl: See next page

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DATE	9/12/02	9/18/02	9/18/02	9/4/02	10/1/02

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUESTS RR-89-34 AND RR-89-36

FOR REPAIR OF REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

MILLSTONE POWER STATION, UNIT NO. 2

DOMINION NUCLEAR CONNECTICUT, INC.

DOCKET NO. 50-336

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (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). Section 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee 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, “Rules for Inservice Inspection 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 inservice inspection code of record for the third 10-year ISI interval at Millstone Power Station, Unit No. 2 (MP2) is the 1989 Edition with no Addenda of Section XI of the ASME Code.

By letter dated February 25, 2002, as supplemented March 13, March 19, and March 21, 2002, Dominion Nuclear Connecticut, Inc. (the licensee), submitted Relief Requests RR-89-34, Revision 1, and RR-89-36, for MP2. The submittal requested relief from certain requirements of the ASME Code for repair of reactor pressure vessel (RPV) head penetration nozzles associated with the control element drive mechanisms (CEDMs). Specifically, the licensee

Enclosure

requested relief from ASME Code, Section III, 1992 Edition, subparagraph NB-4622, which requires elevated temperature preheat and post-weld soak, and ASME, Section XI, 1989 Edition, subparagraph IWA-4310, which requires that defects be removed or reduced to an acceptable size. As an alternative, the licensee proposed a repair using a remotely operated, gas tungsten-arc welding (GTAW) process. The GTAW process utilizes an ambient temperature temper bead method with a 50 °F minimum preheat temperature and no post-weld heat treatment (PWHT). Defects not removed from the original J-groove weldment would be analytically evaluated for acceptability using the worst-case scenario. The licensee also requested using ASME Section XI, 1992 Edition, as it applies to its flaw evaluation and system leakage test requirements.

MP2 is currently in its third 10-year ISI interval. The temper bead weld repair, associated examinations, and inservice inspections, will be conducted in accordance with Sections III and XI of the 1992 Edition of the Code and alternative requirements discussed herein. All other items will be in accordance with the inservice inspection Code of record, Section XI of the 1989 Edition of the Code, and alternative requirements discussed herein. The Construction Code for MP2 is the 1968 Edition with Summer 1969 Addenda of the Code, and their ISI Code of record is the 1989 Edition of Section XI of the Code. Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requested relief from the requirements of the following Sections III and XI Code requirements.

2.0 RELIEF REQUEST RR-89-34, REVISION 1 - USE OF ALTERNATIVE TO WELD REPAIR REQUIREMENTS FOR RPV HEAD PENETRATION NOZZLES

The components affected by this request for relief are the 69 RPV head penetration nozzles associated with the CEDMs. The licensee identified that three of the CEDM nozzles require repair. The following is the staff's evaluation of Relief Request RR-89-34, Revision 1.

2.1 Code Requirements

The 1992 Edition of ASME Section III, NB-4622, “Post-Weld Heat treatment (PWHT) Time and Temperature,” states the requirements for PWHT. Specifically, the 1992 Edition of ASME Section III, NB-4622.11, “Temper Bead Weld Repair to Dissimilar Metal Welds or Buttering,” states that whenever PWHT 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 PWHT or after the final PWHT, provided the requirements of the subparagraphs NB-4622.11(a) through (g) are met.

The 1992 Edition of ASME Section III, NB-4453.4, “Examination of Repaired Welds,” states that examination of a weld repair shall be repeated as required for the original weld. For partial penetration welds, NB-5245 requires a progressive surface examination at the lesser of ½ the maximum weld thickness or ½-inch as well as a surface examination on the finished weld.

The 1989 Edition of ASME Section XI, IWA-4710(a), states that after a welded repair on a pressure retaining boundary or the installation of a replacement by welding, a system hydrostatic test shall be performed in accordance with IWA-5000.

2.2 Proposed Alternative

Repairs to RPV head penetration J-groove attachment welds which are required when 1/8 inch or less of nonferritic weld deposit exists above the original fusion line, will be made in accordance with the requirements of paragraphs IWA-4110, 4120, 4130, 4140, 4210, 4330, 4340, 4400, 4600, 4700, and 4800 of the 1989 Edition of ASME Section XI with the alternative requirements.

As an alternative to the PWHT time and temperature requirements of NB-4622, the requirements of "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique" will be used as described in Enclosure 1 of the March 13, 2002, submittal except that ultrasonic testing (UT) examination coverage is as listed in the March 19, 2002, submittal and the UT acceptance criteria do not apply to the triple point anomaly. NB-4622.1 through NB-4622.10 are not applicable for the proposed alternative because they apply to a different welding process. The proposed alternative specifically applies to the following subparagraphs of ASME Section III, NB-4622.11 as discussed below:

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

NB-4622.11(a), (b), (c)(1), (e), and (g) will be performed in accordance with Code requirements.

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 utilizes GTAW with bare electrodes meeting either the A-No. 8 or F-No. 43 classifications.

NB-4622.11(c)(3) discusses 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 that do not require storage in heated ovens since bare electrodes will not pick up moisture from the atmosphere.

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

NB-4622.11(c)(5) requires preheat to a minimum temperature of 350 °F prior to repair welding. The proposed ambient temperature temper bead alternative does not require elevated temperature preheat.

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 controls the tempering process by precise control of heat input and bead placement; the 3/32, 1/8, and 5/32 inch electrodes required by NB-4622.11(c)(6), and the requirement to remove the weld crown of the first layer is unnecessary. The proposed alternative does not include these requirements.

NB-4622.11(c)(7) requires a hydrogen bake out be performed on the preheated area by heating from 450 °F to 550 °F for 4 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 temperbead procedure does not require the hydrogen bake out.

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 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 with acceptable properties in both the weld and heat affected zone (HAZ).

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 very low hydrogen GTAW temperbead welding process. Liquid penetrant examination will be performed per NB-4622.11(d)(2).

NB-4622.11(d)(2) requires liquid penetrant and radiographic examinations of the repair welds after a minimum of 48 hours at ambient temperature. UT 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, final inspection will be by liquid penetrant and UT inspection.

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 inspection required by NB-5245 will not be done. In lieu of the progressive liquid penetrant examination, the proposed alternative will use liquid penetrant and ultrasonic examination of the final weld.

NB-4622.11(f) establishes requirements for the procedure qualification test plate relative to the P-No. and Group Number and the PWHT of the materials to be welded. The proposed alternative complies with those requirements, with the additional requirements of the alternative that the root width and included angle of the cavity are stipulated to be no greater than the minimum specified for the repair. In addition, the location of the V-notch for the Charpy test is more stringently controlled in the proposed alternative than in NB-4622.11(f).

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 per 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 penetrant (PT) or magnetic testing (MT) at the lesser of ½ 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 PT and UT no sooner than 48 hours after the weld has cooled to ambient temperature in lieu of the progressive surface examinations required by NB-5245.

IWA-4700 of ASME Section XI, 1989 Edition requires a system hydrostatic test in accordance with IWA-5000 for welded repairs to the pressure-retaining boundary. The proposed alternative will utilize a system leakage test per IWA-5211(a) of ASME Section XI, 1992 Edition.

2.3 Licensee's Basis for Proposed Alternative

The following section provides the licensee's basis for the proposed alternative. For the most part, the text is verbatim from the licensee's submittal dated March 13, 2002. However, some of the text was edited for clarity or revised to reflect further information provided in the submittals dated March 19 and 21, 2002.

The alternative to 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 features of the alternative that make it applicable and acceptable for the contemplated repairs are enumerated below:

1) The proposed alternative will require the use of an automatic or machine GTAW temperbead 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 Enclosure 1 of the licensee's submittal dated March 13, 2002, "Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique" and specifies that all other requirements of IWA-4000 are met. The alternative will be used to make welds of P-No. 3, RPV material to P-No. 43 head penetration using F-No. 43 filler material.

2) The use of a GTAW temperbead welding technique to avoid the need for postweld heat treatment is based on research that has been performed by EPRI and other organizations (Reference, EPRI Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temper Bead 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 zones (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 heat affected zones in both cases. The temperbead process has been shown effective by research, successful procedure qualifications, and many successful repairs performed since the technique was developed. Many acceptable Procedure Qualifications Records (PQRs) and Welding Procedure Specifications (WPSs) presently exist and have been used to perform numerous successful repairs. These repairs have included all of the Construction Book Sections of the ASME Code, as well as the National Board Inspection Code (NBIC). The use of the automatic or machine GTAW process utilized for temperbead welding allows more precise control of heat input, bead placement, and bead size and contour than the manual SMAW process required by NB-4622. The very precise control over these factors afforded by the alternative provides more effective tempering and eliminates the need to grind or machine the first layer of the repair.

3) The NB-4622 temperbead procedures require a 350 °F preheat and a postweld soak at 450 °F - 550 °F for 4 hours for P-No. 3 materials. Typically, these kinds of restrictions are

used to mitigate the effects of the solution of monatomic hydrogen in ferritic materials prone to hydrogen embrittlement cracking. The susceptibility of ferritic steels is directly related to three factors: 1) the propensity of the material to transform to a crack susceptible micro structure; 2) the level of monatomic hydrogen present; and 3) the level of tensile stress. The P-No. 3 material of the RPV head is able to produce martensite from the heating and cooling cycles associated with welding. However, the proposed alternative mitigates all three factors without the use of elevated preheat and postweld hydrogen bake-out by closely controlling the welding heat input, bead placement and minimizing the introduction of hydrogen in the welding process.

The NB-4622 temperbead 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 temperbead procedures require preheat and postweld hydrogen bake-out. However, the proposed alternative temperbead procedure utilizes the machine GTAW process which is essentially free of hydrogen. The GTAW process relies on bare welding electrodes with no flux to trap moisture. An inert gas blanket positively shields the weld and surrounding material from the atmosphere and moisture it may contain. It produces by far the lowest hydrogen levels of any of the commonly used arc welding processes. To further reduce the likelihood of any hydrogen evolution or absorption, the alternative procedure requires particular care to ensure the weld region is free of all sources of hydrogen. The GTAW process will be shielded with welding-grade argon (99.9996% pure) which typically produces welds essentially free of hydrogen. A typical argon flow rate would be about 15 to 50 cubic feet per hour and would be adjusted to ensure adequate shielding of the weld without creating a venturi affect that might draw oxygen or water vapor from the ambient atmosphere into the weld.

4) The F-No. 43 (ERNiCrFe-7) filler metal that would be used for the repairs is not subject to hydrogen embrittlement cracking.

5) Final examination of the repair welds would be a combination of surface examination (liquid penetrant) and ultrasonic examination 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 3/8-inch limit on repair depth in the ferritic materials, 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 nonferritic weld material which has a higher solubility for hydrogen and is much less prone to hydrogen embrittlement cracking. Thus, in the highly unlikely event that hydrogen induced cracking did occur, it would be detected by the 48-hour delay in examination.

6) Results of procedure qualification work undertaken to date indicate that the proposed alternative produces sound and tough welds. Typical tensile test results appear as ductile breaks in the weld metal. As shown below, Procedure Qualification Record (FRA-ANP PQR 7164) using P-No. 3, Group No. 3 base material exhibited improved Charpy V-notch properties in the HAZ. Absorbed energy, lateral expansion and % shear area were all improved, compared to the unaffected base material.

PQR 7164	Unaffected Base Material	HAZ
50 °F absorbed energy (ft-lbs.)	69, 55, 77	109, 98, 141
50 °F lateral expansion (mils)	50, 39, 51	59, 50, 56
50 °F shear fracture (5%)	30, 25, 30	40, 40, 65
80 °F absorbed energy (ft-lbs.)	78, 83, 89	189, 165, 137
80 °F lateral expansion (mils)	55, 55, 63	75, 69, 60
80 °F shear fracture (5%)	35, 35, 55	100, 90, 80

The absorbed energies, lateral expansion, and percent shear fracture were significantly greater for the HAZ than the unaffected base material at both test temperatures.

Procedure Qualification Record (FRA-ANP PQR 7183) using P-No. 3, Group No. 3 to P-No. 43 base material with F-No. 43 filler metal exhibited improved Charpy V-notch properties in the HAZ absorbed energy, and % shear area perspectives, but had slightly lower average lateral expansion compared to the unaffected base material.

PQR 7183	Unaffected Base Material	HAZ
30 °F absorbed energy (ft-lbs.)	59, 54, 61	82, 95, 94
30 °F lateral expansion (mils)	53, 51, 47	41, 48, 54
30 °F shear fracture (%)	20, 30, 20	65, 70, 70
35 °F absorbed energy (ft-lbs.)	n/a	95, 84, 95
35 °F lateral expansion (mils)	n/a	49, 52, 50
35 °F shear fracture (%)	n/a	45, 35, 55

The absorbed energy and percent shear fracture were significantly greater for the HAZ than the unaffected base material. However, the mils lateral expansion averaged slightly less than that of the unaffected base material, (i.e., 48 mils vs 50). This can be compensated for by making an adjustment in the nil ductility temperature of materials repaired with this procedure.

The difference between the results for the mils lateral expansion for these two qualification tests, which were welded with identical weld parameters, filler metal, and equipment, can only be attributed to the difference in the nil ductility temperature RT_{NDE} of the base material used.

7) The welding procedure qualifications supporting the applicable WPSs to be used for the repair weld are for P-No. 3, Group No. 3 base material welded to P-No. 43 base material with F-No. 43 filler metal, and P-No. 43 to P-No. 43 base material welded with F-No. 43 filler metal. Using these WPSs, the proposed alternate provides a technique for repairing CEDM penetrations in the RPV head that will produce sound, permanent repairs with an acceptable level of quality and safety.

8) IWA-4700 requires a system hydrostatic test in accordance with IWA-5000 for welded repairs to the pressure retaining boundary. In lieu of a system hydrostatic test which must be conducted at pressures exceeding normal operating pressure, the proposed alternative relies on a system leak test at normal operating pressure coupled with nondestructive testing of the proposed weld that offers an equivalent or higher confidence of the soundness of the weld. As previously discussed, NB-5245 requires progressive surface examination of the proposed partial penetration welds while the alternative requires final

surface examination (liquid penetrant inspection) and volumetric examination (ultrasonic inspection) which will provide added assurance of sound welds when done in conjunction with the planned system leak test. Since the proposed testing is similar to the provisions of approved ASME Code Case 416-1, the licensee concluded that the proposed alternative provides an acceptable level of quality and safety.

9) The closure head preheat temperature will be essentially the same as the reactor building ambient temperature; therefore, closure head preheat temperature monitoring in the weld region and using 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 closure head is sufficient.

   In lieu of using thermocouples for interpass temperature measurements; calculations, Welding Procedure Qualification tests, and previous experience all show that the 350 °F maximum interpass temperature will never be exceeded.

   The calculation is based on a typical inter-bead time interval of 5 minutes. The 5-minute inter-bead interval is based on: 1) the time required to explore the previous weld deposit with the two remote cameras housed in the weld head; 2) time to shift the starting location of the next weld bead circumferentially away from the end of the previous weld-bead; and 3) time to shift the starting location of the next bead axially to ensure a 50% weld bead overlap required to properly execute the temperbead technique. The calculation shows that the interpass temperature at the start of a weld bead will return to within 1.23 °F of the initial temperature prior to the start of the next weld pass.

   A welding mockup was performed on a full size Midland reactor vessel closure head (RVCH). This is a different design but is close enough to MP2 to demonstrate the overall effect of this welding technique and on interpass temperature. 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 closure head within a 5-inch band surrounding the CEDM nozzle. Three other thermocouples were placed on the closure head inside surface. One of the three thermocouples was placed 1-1/2 inches from the CEDM nozzle penetration, on the lower hillside. The other inside surface thermocouples were placed at the edge of the 5-inch band surrounding the CEDM nozzle, one on the lower hillside, the second on the upper hillside. During welding of the mockup, all thermocouples fluctuated less than 15 °F throughout the welding cycle. For the Midland RVCH mockup application, 300 °F minimum preheat temperature was used and the interpass temperature never rose above 315 °F.

   Welding Procedure Qualification tests performed using the same parameters but on plates with much smaller heat sink and without the 5-minute reset time between passes recorded maximum interpass temperatures of 142 °F and 99 °F from the initial ambient temperature of approximately 70 °F.

10) UT will be performed in lieu of radiographic testing (RT) due to the repair weld configuration. Meaningful RT cannot be performed. The weld configuration and geometry of the penetration in the head 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 both UT and PT.

The effectiveness of the UT techniques to characterize the weld defects has been qualified by demonstration on a mockup of the repair temperbead weld involving the same materials used for repair. Notches were machined into the mockup at depths of 0.10", 0.15", and 0.25" in order to quantify the ability to characterize the depth of penetration into the nozzle. The depth characterization is done using tip diffraction UT techniques that have the ability to measure the depth of a reflector relative to the nozzle bore. Each of the notches in the mockup could be measured using the 45-degree transducer. During the examination longitudinal wave angle beams of 45-degrees and 70-degrees are used. These beams are directed along the nozzle axis looking up and down. The downward looking beams are effective at detecting defects near the root of the weld because of the impedance change at the triple point (intersection of weld material, penetration tube, and vessel head). The 45-degree transducer is effective at depth characterization by measuring the time interval to the tip of the reflector relative to the transducer contact surface. The 70-degree longitudinal wave provides additional qualitative data to support information obtained with the 45-degree transducer. Together, these transducers provided good characterization of possible defects. These techniques are routinely used for examination of austenitic welds in the nuclear industry for flaw detection and sizing.

In addition to the 45- and 70-degree beam angles described above, the weld is also examined in the circumferential direction using 45-degree longitudinal waves in both the clockwise and counterclockwise directions to look for transverse fabrication flaws. A 0-degree transducer is also used to look radially outward to examine the weld and adjacent material for laminar type flaws and evidence of underbead cracking.

11) The repair weld UT examination of the triple point location described above is anticipated to result in a UT indication. This UT indication would be from this triple point weld anomaly and may appear to be a crack or incomplete penetration type of flaw that can only be characterized as unacceptable in accordance with NB-5330(b). In order to address this anticipated UT indication it will be evaluated in accordance with IWB-3600 of the 1992 Edition of ASME Section XI. The licensee determined that in order to perform an IWB-3600 evaluation of these anticipated flaws, it would be necessary to use the linear elastic fracture mechanics provisions of Appendix A of Section XI. Since Appendix A is “In the course of preparation” in the 1989 Edition of ASME Section XI, it will be necessary to use the 1992 Edition and ASME Section XI, IWA-4120(c), which states the following:

“Later Editions and Addenda of Section XI, either in their entirety or portion thereof, may be used for the repair program, provided that Editions and Addenda of Section XI at the time of the planned repair have been incorporated by reference in amended regulation of the regulatory authority having justification at the plant site.”

The letters dated March 19 and 21, 2002, stated that no recordable indications were detected at the triple point after completion of the UT examination. Therefore, the licensee stated that the request for relief from NB-5330 is not applicable and, therefore, was withdrawn.

12) The welding head has video capability for torch positioning and monitoring during welding. The operator observes the welding operation as well as observing each bead deposited prior to welding the next bead. The video clarity and resolution is such that the welding operator can observe a ½-mil diameter color contrast wire.

13) The automated repair method previously described leaves a band of ferritic low alloy steel exposed to the primary coolant. The effect of corrosion on the exposed area, both reduction of RPV head thickness and primary coolant Iron (Fe) release rates, has been evaluated by Framatome-ANP (FRA-ANP). The results of this evaluation concluded that the total corrosion would be insignificant when compared to the thickness of the RVCH. FRA-ANP has estimated that the total estimated Fe release from a total of 69 repaired CEDM nozzles would be significantly less than the total Fe release from all other primary sources. Since MP2 has 69 CEDM nozzles, this estimate is applicable.

2.4 Staff Evaluation

NB-4622.11 states that "Whenever PWHT 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 PWHT or after the final PWHT provided the requirements of the following subparagraphs are met." The licensee will be using F-No. 43 Inconel filler weld material to join Inconel pipe to P-No. 3 carbon steel RPV head. The proposed alternative will significantly reduce radiation doses to repair personnel. The licensee stated that the repair of the three CEDM penetrations using the machine ambient temper bead welding process is expected to incur a total exposure to personnel of about 60 man-rem or about 20 man-rem per weld. Because of the difficulty encountered in gaining access to the surface of the head due to the design of the insulation, it is estimated that removal of insulation, placement and removal of heating blankets, and conducting the necessary heating operations would add about 25 man-rem to the exposure.

The function of PWHT is to minimize hydrogen cracking after welding, and to a lesser extent, reduce stresses associated with the transformation from austenitic to ferritic micro structures. The temper bead is expected to reduce transformation stresses. The licensee contends that the tight controls necessary for automatic temper bead GTAW creates a low hydrogen environment around the molten metal during the welding process. The GTAW process uses bare electrodes and shields the molten puddle with high purity argon gas (99.999% pure). In the absence of welding fluxes and air, the repair area is essentially free of hydrocarbons and moisture. In addition, the combined effects from the confined welding location under the head and hydrogen preference for hydrogen crack resistant austenitic weld metal all contribute to the reduction of dissolved hydrogen in the metal, thus lessening the likelihood of hydrogen cracking. The welding procedures used by the licensee were qualified without PWHT. Based on the preceding discussion, the proposed alternative would produce essentially the same after weld results as a Code-required PWHT of the CEDM, J-groove, and surrounding vessel head. Therefore, the staff finds that a PWHT will result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The licensee will satisfy the Code-requirements of Sub-subsections NB-4622.11(a), NB-4622.11(b), NB-4622.11(c)(1), NB-4622.11(e), and NB-4622.11(g).

NB-4622.11(c)(2) requires the use of the SMAW process with covered electrodes meeting either the A-No. 8 or F-No. 43 classifications. The proposed alternative utilizes GTAW with bare electrodes meeting either the A-No. 8 or F-No. 43 classifications. In the proposed welding atmosphere, the electrodes will make a weld exhibiting the same physical and micro structural characteristics as one made with the SMAW process.

NB-4622.11(c)(3) discusses 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 that do not require storage in heated ovens since bare electrodes will not pick up or store moisture from the atmosphere.

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

NB-4622.11(c)(5) requires preheat to a minimum temperature of 350 °F prior to repair welding, a maximum interpass temperature of 450 °F, thermocouples and recording instruments for monitoring metal temperatures during welding. In lieu of using thermocouples and recording instruments for interpass temperature measurements, calculations show that the maximum interpass temperature will not exceed the maximum allowable temperatures because of the low welding heat input, weld bead placement, travel speed, and conservative preheat temperature assumptions. The physical aspects of manipulating the equipment from completing one layer and adjusting for the next layer returns the weld to near ambient temperature. Heat input beyond the third layer will not have a metallurgical effect on the low alloy steel heat affected zone, but will affect austenitic grain growth and UT. A welding mockup on the full-size Midland RPV head was used to demonstrate the proposed alternative. During welding of the mockup, the temperature variations were less than 15 °F throughout the welding cycle. The proposed ambient temperature temper bead alternative does not require elevated temperature preheat because of the preparations to minimize hydrogen during the welding process.

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 weld filler metal diameters much smaller than the 3/32, 1/8, and 5/32-inch electrodes required by NB4622.11(c)(6), the requirement to remove the weld crown of the first layer is unnecessary. The smaller diameter weld wire lays down a thinner layer of weld metal with each pass. The precise controls on the automatic welding process minimize variations, thus producing a smooth weld surface with sufficient heat to relief the stresses in the preceding layer. Therefore, the proposed alternative does not include the removal of the weld bead crown or PWHT.

NB-4622.11(c)(7) requires the preheated area to be heated from 450 °F - 660 °F for a period of at least 4 hours after a maximum of 3/16-inch of weld metal has been deposited. As discussed in the licensee's basis for relief and the Electric Power Research Institute (EPRI) Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temperbead Applications," the proposed alternative does not require heat treatment because the GTAW temper bead process

uses extremely low hydrogen electrodes and shields the weld area and molten metal with argon, thus making a hydrogen bake-out unnecessary.

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 and requires the area to be welded be at least 50 °F prior to welding. These limitations have been demonstrated to be adequate to produce sound welds and are the same limits in Code Case N-638, “Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique,” which has been endorsed by the staff in the Draft Regulatory Guide DG-1091, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1.”

NB-4622.11(d)(1) requires a PT examination after the hydrogen bake-out described in NB-4622.11(c)(7). The proposed alternative does not require the hydrogen bake-out because the very low hydrogen ambient GTAW temper bead welding process makes it unnecessary. The PT will be performed as a post-weld examination.

NB-4622.11(d)(2) requires PT and RT of the repair welds after a minimum of 48 hours at ambient temperature. UT is required if practical. The proposed alternative includes the requirement to inspect after a minimum of 48 hours at ambient temperature. For an effective RT examination, the radioactive source and film must be placed in a location such that the material thickness between them is fairly constant and that exposure to extraneous radiation is minimized. This specially designed weld configuration is not conducive to RT examinations. The proximity of other penetrations would limit the ability to place a source. The RPV head curvature would interfere with the source-to-film alignment causing image distortion and geometric unsharpness. The effect of the RPV head geometry would involve continuous variation in material thickness from one edge of the radiograph to the other with consequent difficulty in achieving acceptable film densities. Also the radiation field on contact with the head would result in fogging of the RT film and affect interpretation of the results. Therefore, UT will be used in lieu of the Code-required RT. The effectiveness of the UT was demonstrated on a mockup temper bead weld involving the same material as will be used for this repair.

NB-4622.11(d)(3) requires that all nondestructive examinations (NDE) be in accordance with NB-5000. The proposed alternative will comply with NB-5000 for the NDE that will be used. In lieu of the progressive PT required by NB-5245 and RT required by NB-4622.11(d)(2), the proposed alternative will use PT and UT in accordance with NB-5000 for examinations of the final weld.

ASME Section III, 1992 Edition, paragraph NB-5245 gives the NDE requirements for partial penetration welds. The requirements are to conduct progressive MT or PT examinations. The finished surface is also to be examined by one of these methods. However, the licensee has proposed to eliminate the progressive surface examinations and to conduct a surface examination and a UT examination of the finished surface after the completed weld has been at ambient temperature for at least 48 hours. The staff finds that the progressive examinations would be difficult to conduct because of interferences caused by the presence of the automatic GTAW welding equipment. The surface examinations will identify any surface penetrating flaws. The UT examinations should find construction- and repair-related flaws when performed using appropriately qualified processes, procedures, and personnel.

The staff has concluded that NB-5245 is not the appropriate Code section that applies to the repair since the weld configuration is not that of a partial penetration weld. The repair weld is actually a specially designed structural weld that is used to reestablish the pressure boundary between the CEDM nozzle and RPV head. The weld configuration is not addressed by the figures referenced by IWB-2500-1. For analysis purposes, the licensee evaluated the weld to meet the structural requirements of a partial penetration weld, and for integrity purposes, the licensee performed surface and volumetric examinations. The staff has determined that the proposed surface and volumetric examinations of the repair welds are acceptable for verification of weld integrity.

NB-4622.11(f) establishes requirements for the procedure qualification test plate. The proposed alternative complies with those requirements, except the root width and included angle of the cavity will be no greater than the minimum specified for the repair which is more stringent than Code-required. In addition, the location of the V-notch for the Charpy test is more stringently controlled in the proposed alternative than in NB-4622.11(f). The proposed alternative also includes the additional provisions of ASME Section III, paragraph NB-4335.2, for adjustment of the nil ductility temperature (RT_{NDT}) if required by the results of the procedure qualification.

As part of the preparation for the weld repair, the licensee's contractor fabricated a weldment for demonstrating a CEDM field repair (Reference, Framatome ANP, "CRDM Nozzle ID Temper Bead Weld Repair Process Qualification," BAW-2409P, September 2001). An examination of an as-welded cross section revealed a defect identified by the contractor as a weld solidification anomaly. This anomaly is located where three different metals come together (triple point): Alloy 600 CEDM, carbon steel RPV head, and Alloy 690 weld metal. A cross-section made of the triple point showed a void between the CEDM and RPV head extending into the weld metal. The void surface was jagged with two crack-like projections curving into the weld metal. The cross section magnification was insufficient to identify the cause of the curved crack-like projections. The existence of the void and crack-like projections create an indeterminate condition (anomaly). Because of the limited information pertaining to the origin of the anomaly found in the contractor fabricated weldment, the staff concludes that if an anomaly exists at the triple point following a CEDM nozzle repair, the licensee should treat the anomaly as a defect which must be monitored and/or analyzed in order to ensure weld integrity. The licensee's submittal dated March 21, 2002, provided the following information regarding analysis of the UT examination of the triple point subsequent to the weld repair:

> Based upon industry experience with the triple point anomaly, Millstone Unit No. 2 submitted relief request RR-89-34 with the expectation of finding similar indications after repair welding. These indications were expected to be greater than 100% Distance Amplitude Correction (DAC) and possibly not meet the acceptance criteria of NB-5330.
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> After repair welding of nozzles 21, 34 and 50 at Millstone Unit No.2, an ultrasonic examination was performed. On the morning of March 18, 2002, the analysis of these examinations had begun. We asked the analysts that were performing the analysis if they detected the triple point weld anomaly, and they stated that they had detected them. We communicated this information to the NRC in the conference call.
>
> After the conference call, the analysis of the ultrasonic examination was completed and there were no indications greater than 100% of DAC. Indications at the triple point

anomaly with low amplitudes were observed in all three nozzles intermittently, for essentially 360°. Indications in two nozzles required interrogation (≥20% DAC) to determine their shape size and identity as required by NB-5330.

No indications were interpreted to be a crack, lack of fusion, or lack of penetration.

As the indications were less than 100% DAC, they did not meet the recording threshold of NB-5330 and do not require evaluation to the acceptance criteria.

Based on the preceding discussions, the staff has determined that the proposed alternative to use the ambient temperature temper bead process in lieu of the Code-required temper bead process will produce a permanent repair weld. The repair weld ensures adequate structural integrity. Compliance with the specified Code-required RT examination would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. However, because of the lack of operational history of this type of pressure boundary weld, to ensure continued structural integrity of the repair welds, these welds must be examined ultrasonically for three successive examinations, on a frequency of no less than once every other refueling outage. Any flaw indication identified should be evaluated in accordance with IWB-3500 and IWB-3600 of the ASME Code.

IWA-4710(a) and IWA-5214 state that after a repair weld is made on a pressure retaining boundary or the installation of a replacement by welding, a system hydrostatic test shall be performed in accordance with IWA-5000. The licensee has proposed to perform a system leakage test in lieu of the system hydrostatic test, similar to that which is described in Code Case N-416-1 for ISI requirements. The NRC has endorsed the use of Code Case N-416-1. One of the conditions imposed by Code Case N-416-1 for use of a system leakage test is that the NDE requirements of the applicable subsection of ASME, Section III, 1992 Edition be met. Since the weld configuration of the proposed weld is not addressed in Section III, no Code-required NDE can be referenced and, therefore, the proposed NDE is acceptable for this purpose. Based on the arguments about the acceptability of the licensee's proposed alternative to NB-5245 as discussed in the preceding paragraphs, the staff finds the performance of a system leakage test as proposed by the licensee to be an acceptable alternative to the Code-required post-repair system hydrostatic test.

Based on the above evaluation, the staff finds that compliance with the Code-required in-process and post-repair examination requirements would result in hardship or difficulty without a compensating increase in the level of quality and safety, and that the licensee's proposed alternative to perform post-repair surface and ultrasonic examinations and a system leakage test, in lieu of the Code-required post-repair examination requirements, is acceptable. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is acceptable.

2.5 Conclusion

Based on the preceding discussion for Relief Request RR-89-34, Revision 1 the staff has concluded that the proposed alternative to use the ambient temperature temper bead process as verified by the proposed in-process and repair examinations described by the licensee will ensure adequate structural integrity. Based on the preceding evaluation, the staff concluded that compliance with the Code-required in-process and post-repair examinations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized for the third 10-year ISI interval. As discussed in Section 2.4 of this Safety Evaluation, to ensure continued structural integrity of the repair welds, these welds must be examined ultrasonically for three successive examinations, on a frequency of no less than once every other refueling outage. Any flaw indication identified should be evaluated in accordance with IWB-3500 and IWB-3600 of the ASME Code.

3.0 RELIEF REQUEST RR-89-36 - CHARACTERIZATION AND SUCCESSIVE EXAMINATIONS OF REMAINING FLAWS IN RPV HEAD PENETRATION NOZZLES

The components affected by this request for relief are the 69 RPV head penetration nozzles associated with the CEDMs. The licensee identified that three of the CEDM nozzles require repair. The following is the staff's evaluation of relief request RR-89-36.

3.1 Code Requirements

The 1989 Edition of ASME Section XI, IWA-3420, states that each detected flaw or group of flaws shall be characterized by the rules of IWA-3300 to establish the dimensions of the flaws.

The 1989 Edition of ASME Section XI, IWA-3300, requires characterization of flaws detected by inservice examinations.

The 1989 Edition of ASME Section XI, IWB-3142.4, references IWB-2420(b) which requires that the areas containing flaws or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the inspection program of IWB-2400. In a letter dated March 19, 2002, the licensee withdrew the alternative to this requirement.

3.2 Proposed Alternative

In lieu of IWA-3420 and IWA-3300 of the 1989 Edition, the licensee's proposed alternative is to use the worst-case assumptions to conservatively bound the extent and orientation of flaws in the J-groove welds. The evaluation includes flaw growth and fracture mechanics of the assumed flaw configuration.

In lieu of the three successive examination requirement of IWB-3142.4 (i.e., in lieu of IWB-2420(b)), the licensee's proposed alternative is no additional inspections because of the difficulty in characterizing the cracks left in the J-groove weld and the analytical evaluation using a worst-case scenario.

3.3. Licensee's Basis for Proposed Alternative Relief and Staff Evaluation

IWA-3420 requires that detected flaws be characterized. The staff has determined that characterization of any cracks in the J-groove weld region is extremely difficult to perform UT on due to the compound curvature and acoustical interference inherent in the materials and between materials. These conditions prevent ultrasonic coupling and control of the sound beam that is necessary for sizing cracks with any degree of confidence. The angle of incidence from the outer surface of the closure head base material does not permit perpendicular interrogation by UT using shear wave techniques for circumferentially oriented flaws and the

physical proximity of the nozzle does not allow for longitudinal scrutiny of the area of interest. Cladding will provide an acoustic interface which will severely limit a confident examination of the weld material and characterization of an existing flaw. RT of this area is impractical because flaws oriented perpendicular to gamma and x-rays are difficult to detect and the triple point anomaly would mask any flaws behind it. PT examination will show linear surface growth; however, the linear growth can only indicate if there is volume growth.

IWA-3300(a) of the ASME Code states that flaws detected by the preservice and inservice examinations shall be sized by the bounding rectangle or square for the purpose of description and dimensioning. IWA-3300(b) of the ASME Code states that flaws shall be characterized in accordance with IWA-3310 through IWA-3390, as applicable. IWB-3132.4(a) of the ASME Code states that components whose volumetric or surface examination reveal flaws that exceed the acceptance standards listed in Table IWB-3410-1 shall be acceptable for service without the flaw removal, repair, or replacement if an analytical evaluation, as described in IWB-3600, meets the acceptance criteria of IWB-3600. The licensee proposed that the cracks be accepted by analysis of the worst case that might exist in the J-groove. For the analysis, the licensee assumed that crack growth was limited to the Alloy 600 J-groove weld. The blunting of crack at the carbon steel vessel-to-nozzle is supported by plant experiences.

The licensee calculated the applicable stresses required for the fracture mechanics evaluation along pathways of expected flaw propagation of a flaw in the J-groove weld. For the fracture mechanics evaluation, the licensee determined that hoop stresses were the dominant stress. The expected flaw, therefore, would be in the radial direction. Using a worst-case geometry of the as-left weld, the postulated flaw was assumed to begin at the intersection of the RPV head inner diameter surface and the CEDM nozzle bore and propagate through the weld. Based on the analysis, the licensee determined that a postulated flaw within the weld is acceptable for 35 years.

The licensee evaluated the effects of corrosion on a crack in the RPV head from the reactor primary water. The crack would be exposed to low oxygenated boric acid primary water. The evaluations concluded that cracks exposed to deoxygenated boric acid solutions typical of reactor primary water corrodes the RPV at a rate of 0.001 inches per year or less at 590 °F.

The repair being proposed by the licensee will move the pressure boundary from the J-groove weld to the temper bead repair weld. The licensee conducted a three-dimensional finite element analysis of the CEDM nozzle, repair weld, and remnant portions of the original Alloy 600 weld at the most severe hillside orientation. The maximum cumulative fatigue usage factor was calculated to be within the Code limitation of 1.0 for an assumed 35-year future plant life.

IWB-3132.4(b) of the ASME Code states where the acceptance criteria of IWB-3600 are satisfied, the area containing the flaw shall be subsequently reexamined in accordance with IWB-2420(b) and (c). IWB-2420(b) states if the flaw indications or relevant conditions are evaluated in accordance with IWB-3132.4 or IWB-3142.4, respectively, and the component qualifies as acceptable for continued service, the areas containing such flaw indications or relevant conditions shall be reexamined during the next three inspection periods listed in the schedules of the inspection programs of IWB-2410. The remaining flaws (if any are present) are no longer in a pressure retaining weld and, based on industry experience, they would arrest at the weld butter and RPV head interface. The licensee has analyzed the flaw as acceptable for continued service based on the flaw growing to this size. Successive NDE would not

provide any meaningful information because of the difficulty in characterizing the actual flaws. In order to satisfy the Code the licensee would have to completely remove the crack from the J-groove weld. Experience has shown that the cracks stay confined to the J-groove weld. Therefore, the additional effort and dosage associated with the removal of the crack from the J-groove weld would impose hardship or unusual difficulty without a compensating increase in the level of quality and safety.

As discussed in Section 2.4 of this Safety Evaluation, based on the limited information pertaining to the origin of the anomaly found in the contractor fabricated weldment, the staff concludes that if an anomaly exists at the triple point following a CEDM nozzle repair, the licensee should treat the anomaly as a defect which must be monitored and/or analyzed in order to ensure weld integrity. As discussed in the licensee's submittal dated March 21, 2002, analysis of the UT examination of the triple point subsequent to the MP2 weld repair for nozzles 21, 34, and 50, determined that none of the indications were interpreted to be a crack, lack of fusion, or lack of penetration. The licensee concluded that since the indications were less than 100% DAC, they did not meet the recording threshold of NB-5330 and did not require evaluation to the acceptance criteria.

3.4 Conclusion

Based on the discussion above for Relief Request RR-89-36, the staff has concluded that the proposal to leave cracks in the nonpressure boundary portion of the remaining J-groove partial penetration weld and to evaluate crack growth using the appropriate ASME Section XI criteria for a worst-case crack growth scenario is acceptable. Also, based on the discussion above, the staff has concluded that flaws left in the J-groove penetration weld need not be reexamined during the next three inspection periods. The actions of the licensee provide reasonable assurance of structural integrity for the planned CEDM repair. Therefore, the licensee's proposed alternative for disposition of cracks in the J-groove weld as described in Relief Request RR-89-36 and addressing the staff's concerns pertaining to the triple point provides reasonable assurance of structural integrity. Compliance with the specified Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized for the third 10-year ISI interval.

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