Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

Dominion℠

FEB 25 2002

Docket No. 50-336
B18590

RE: 10 CFR 50.55a(a)(3)(i)

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Nuclear Power Station, Unit No. 2
Request to Use an Alternative to ASME Code Section XI Repair
Welding Requirements by Employing Temper Bead Techniques

Pursuant to the provisions of 10 CFR 50.55a(a)(3)(i), Dominion Nuclear Connecticut, Inc. (DNC), hereby requests permission to use an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, 1989 Edition, repair welding requirements of IWA-4000. Specifically, DNC proposes to use Request RR-89-34, in Attachment 1 of this letter, as the alternative to the ASME Code, Section XI, paragraph IWA-4120, "Rules and Requirements," and paragraph IWA-4500, "Repair Welding." Request 89-34 is in accordance with the methodology of Code Case N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine Gas Tungsten Arc Weld (GTAW) Temper Bead Technique" and additional provisions addressing the qualification requirements for the manual Shielded Metal Arc Weld (SMAW) temper bead technique. This alternative will be used in the event that Reactor Vessel Head Penetration (VHP) leak paths are identified, requiring repair by cutting out the lower portion of a penetration tube. Replacement of that portion of the tube would then be done by using an ambient temperature automatic or machine GTAW temper bead technique. Repair of flaws that are identified within the J-weld or underlying buttering of the head vent or instrument nozzles would be by a manual SMAW temper bead technique.

Millstone Unit No. 2 is currently in the Third 10-Year Inservice Inspection (ISI) Interval which started on April 1, 1999. The 1989 Edition of Section XI applies to the ISI program and is used as the primary Code Edition for Section XI repair/replacement activities. On February 16, 2002, Millstone Unit No. 2 was shutdown for Refueling Outage (RFO 14). Reactor VHP inspections will be conducted during RFO 14 in accordance with our response to the U.S. Nuclear Regulatory Commission (NRC) Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles."[1]

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[1] J. Alan Price letter to U.S. Nuclear Regulatory Commission, "Supplemental Response to NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," dated December 28, 2001.

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Although there are no known flaws or active leaks currently identified where this alternative would be used, if such flaws should be identified and require repair, DNC will be requesting expedited NRC approval of this request. This expedited approval request will be subject to the results of ultrasonic inspections to be performed on the VHP control rod drives from inside the VHP tubes, with the insulation not removed from the reactor vessel head, and liquid penetrant examinations of the J-weld VHP instrumentation nozzles and head vent nozzle if they are found to exhibit evidence of leakage.

Additionally, if there is a need to perform a repair to a control rod drive VHP, a relief request may be necessary in accordance with 10 CFR 50.55a(g)5(iii) based upon the actual repair scenario and the inability to volumetrically characterize flaws remaining in the original J-weld and associated buttering. The current repair scenario for these VHPs calls for removal of the lower portion of the existing VHP tube into the interference fit region of the head. A new alloy 690 replacement tube section would then be inserted into the head. The original tube and replacement tube section would be welded to the vessel head within the interference fit region to form the new reactor coolant pressure boundary. While this repair addresses any existing pressure boundary leakage, there are currently no methods which can assess any potential flaws within the original J-weld and buttering. The proposed approach would be to assume that a conservatively sized flaw exists, considering appropriate stress conditions for any of the control rod drive VHPs, and then to demonstrate that the flaw is acceptable by an ASME B&PV Code, Section XI, 1992 Edition, IWB-3600 analysis. Again, the details of this scenario would be provided along with the relief request in the unlikely event of a repair.

There are no regulatory commitments contained within this letter.

Should there be any questions regarding this submittal, please contact Mr. Ravi G. Joshi at (860) 440-2080.

Very truly yours,

DOMINION NUCLEAR CONECTICUT, INC.

J. Alan Price
Site Vice President - Millstone

Attachment: Request RR-89-34 to Use an Alternative to ASME Code Section XI Repair Welding Requirements by Employing Temper Bead Techniques

cc: H. J. Miller, Region I Administrator
J. T. Harrison, NRC Project Manager, Millstone Unit No. 2
NRC Senior Resident Inspector, Millstone Unit No. 2

Docket No. 50-336
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Attachment 1

Millstone Nuclear Power Station, Unit No. 2

Request RR-89-34 to Use an Alternative to ASME Code Section XI
Repair Welding Requirements by Employing Temper Bead Techniques

Request RR-89-34 to Use an Alternative to ASME Code Section XI Repair Welding Requirements by Employing Temper Bead Techniques

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Request RR-89-34 to Use an Alternative to ASME Code Section XI
Repair Welding Requirements by Employing Temper Bead Techniques

REQUEST: RR-89-34

COMPONENT IDENTIFICATION:

Component: Reactor Pressure Vessel Head Penetrations, (78)

Code Class: 1

System: Reactor Coolant System (RCS)

Code Category: B-E, Pressure Retaining Partial Penetration Welds In Nozzles

Code Item Nos: B4.11, Vessel Nozzles - Head Vent, (1)
B4.12, Control Rod Drive Nozzles - CED-C-01X through CED-C-69X, (69)
B4.13, Instrumentation Nozzles - IF-C-70Z through IF-C-77Z, (8)

References:

(1) 1968 Edition, ASME B&PV Code, Section III, Class A, with Addenda through Summer 1969, and for materials Code Cases 1359-1, 1336, and 1335-2.

(2) 1992 Edition, ASME B&PV Code, Section III, and the 1992 Edition with the 1992 Addenda of Section II for materials.

(3) 1989 Edition, ASME B&PV Code, Section XI, IWA-4120, IWA-4500.

(4) 1995 Edition, ASME B&PV Code, Section XI, with the 1996 Addenda, IWA-4610, IWA-4620, and IWA-4630.

CODE REQUIREMENTS:

Requirements of the ASME B&PV Code, Section XI, 1989 Edition, IWA-4120 and IWA-4500, are applicable to Millstone Unit No. 2 repair welding of the reactor vessel head penetrations (VHPs).

1989 Edition, Section XI, IWA 4120(a), "Rules and Requirements," states:

> *"Repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later Editions 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 ..."

The original Construction Code for the Millstone Unit No. 2 reactor pressure vessel head penetrations is identified above as reference (1). As allowed by IWA-4120(a), DNC will use a later Edition and Addenda of Section III for design, fabrication, and materials as identified in Reference (2). This later Edition of Section III has been chosen based on acceptance in 10 CRF 50.55a and requirements to use the 1992 Edition of Section III for NDE methods and acceptance criteria contained in Code Case N-416-1. Meeting these requirements will allow an alternative pressure test (a system leak test) in lieu of the hydrostatic test required in IWA-4700 of reference (3) and our currently approved safety evaluation report to use Code Case N-416-1.[2]

1989 Edition, Section XI, IWA 4120(c), "Rules and Requirements," states

"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 (10CFR50.55a) of the regulatory authority having jurisdiction at the plant site."

Reference (3), the 1989 Edition of Section XI, applies to the ISI program and is used as the primary Code Edition for Section XI Repair/Replacement activities. As allowed above in IWA-4120(c), Millstone Unit No. 2 has chosen to use IWA-4620 "Similar Materials" and IWA-4630 "Dissimilar Materials" requirements of reference (4) to employ the basic requirements used in performing manual SMAW temper bead welding except for the procedure qualification requirements of IWA-4632 that have been modified by our alternative provided in this request.

PROPOSED ALTERNATIVE

For the application of similar and dissimilar metal welding using the ambient temperature machine GTAW temper bead technique, Millstone Unit No. 2 requests approval to use the following alternative requirements to those outlined in IWA-4120, and IWA-4500 of reference (3), because they do not support the needed or practical parameters necessary to use the temper bead techniques for repair welding our reactor VHPs. Additionally, this alternative includes some added provisions to address procedure qualification requirements for manual SMAW temper bead technique requirements for dissimilar metals in accordance with reference (4).

Repair to P-No. 3, Group 3, except SA-302 Grade B material and their associated welds and P-No. 43 material to P-No. 3, Group 3, except SA-302 Grade B material,

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[2] NRC letter, "Evaluation of the Third 10-Year Interval Inspection Program Plan and Associated Requests for Relief for Millstone Nuclear Power Station, Unit No. 2, (TAC No. M96200)," dated July 22, 1998.

may be made by the automatic or machine GTAW temper bead technique without the specified preheat or post-weld heat treatment of the Construction Code, provided all other provisions outlined in this alternative and all other requirements of IWA-4000 covered in the 1989 Edition of Section XI are met.

1.0 GENERAL REQUIREMENTS:

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

(b) Repair/replacement activities on a dissimilar metal weld in accordance with this alternative are limited to those along the fusion line of a nonferritic weld to the ferritic base metal on which 1/8 in., or less of nonferritic 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 nonferritic weld filler material, may be performed in accordance with this alternative, provided the depth of the repair in the base material does not exceed 3/8 in.

(d) Prior to welding, the area to be welded and a band around the area of at least 1-1/2 (one and a half) times the component thickness or 5 in., whichever is less, shall be at least 50°F.

(e) Welding materials shall meet the requirements of reference (2) and will be specified in the Repair/Replacement Plan. Welding materials shall be controlled so that they are identified as acceptable until consumed.

(f) Peening shall not be used; however, the final surface of the weld and adjacent nozzle I.D. shall receive remediation by abrasive water jet conditioning.

2.0 WELDING QUALIFICATIONS:

The welding procedures and the welding operators shall be qualified in accordance with Section IX and the requirements of the paragraphs addressing Procedure Qualification and Performance Qualification described below.

2.1 Procedure Qualification:

(a) The base materials for the welding procedure qualification shall be of the same P-Number and Group Number, as the materials to be welded. The materials shall be post-weld heat treated to at least the time and temperature that was applied to the materials being welded.

(b) Consideration shall be given to the effects of welding in a pressurized environment. If they exist, these shall be duplicated in the test assembly.

(c) Consideration shall be given to the effects of irradiation on the properties of the material, including weld material for applications in the core belt line region of the reactor vessel. Special material requirements in the design specification shall also apply to the test assembly materials for these applications.

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

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

(f) The test assembly cavity depth shall be at least one-half the depth of the weld to be installed during the repair/replacement activity and at least 1 inch. The test assembly cavity thickness shall be at least twice the test assembly cavity depth. The test assembly shall be large enough to permit the removal of the required test specimens. The test assembly dimensions surrounding the cavity shall be at least the test assembly thickness and at least 6 inches. The qualification test plate shall be prepared in accordance with Figure 1.

(g) Ferritic base material for the procedure qualification test shall meet the impact test requirements of the Construction Code and the Owner's Requirements. The location and orientation of the test specimens shall be similar to those required in (i) below, but shall be in the base material.

(h) Charpy V-notch tests of the F-No. 43 weld metal and P-No. 43 heat-affected zone (HAZ) are not required.

(i) Charpy V-notch tests of the ferritic HAZ shall be performed at the same temperature as the base metal test of (g) above. Number, location, and orientation of test specimens shall be as follows:

1. The specimens shall be removed from a location as near as practical to a depth of one-half the thickness of the deposited weld metal. The coupons HAZ impact specimens shall be taken transverse to the axis of the weld and etched to define the HAZ. The notch of the Charpy V-notch specimen shall 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 shall 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 shall be oriented parallel to the principal direction of rolling or forging.

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

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

2.2 Performance Qualification:

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

3.0 WELDING PROCEDURE REQUIREMENTS:

3.1 Ambient Machine GTAW Temper Bead Technique:

The welding procedure shall include the following requirements.

(a) The weld metal shall be deposited by the automatic or machine 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 area to be welded shall be buttered with a deposit of at least three layers to achieve at least 1/8 inch, overlay thickness as shown in figure 2, Steps 1 through 3, with the heat input for each layer controlled to within $\pm$ 10% of that used in the procedure qualification test. Particular care shall be taken in placement of the weld layers at the toe area of the ferritic material to ensure that the HAZ is tempered. Subsequent layers shall be deposited with a heat input not exceeding that used for layers beyond the third layer in the procedure qualification. For dissimilar metal welding using F-43 filler metal, weld reinforcement is not required to be deposited.

(d) The maximum interpass temperature for field applications shall be 350°F regardless of the interpass temperature used during qualification. The interpass temperature will not be measured directly, but will be maintained below the 350°F maximum as determined by calculation.

(e) Particular care shall be given to ensure that the weld region is free of all potential sources of hydrogen. The surfaces to be welded, filler metal, and shielding gas shall be suitably controlled.

4.0 EXAMINATION:

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

(b) The final weld surface and the area (as appropriate for the applicable nondestructive examination method) adjacent to the weld shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. The ultrasonic examinations shall be in accordance with NB-5000 of reference (2).

(c) If thermocouples are used, areas from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method.

(d) Nondestructive examination personnel shall be qualified in accordance with either NB-5000 of reference (2) or IWA-2300 of reference (3).

(e) Surface examination acceptance criteria shall be in accordance with NB-5340 or NB-5350 of reference (2), as applicable. Ultrasonic examination acceptance criteria shall be in accordance with NB-5000 reference (2). Additional acceptance criteria may be specified by the Owner to account for differences in weld configurations.

5.0 DOCUMENTATION:

Use of this alternative shall be documented in the Repair/Replacement Plan.

6.0 MANUAL SMAW TEMPER BEAD TECHNIQUE:

Manual SMAW Temper bead qualification shall be per reference (4) except for the following:

6.1 Dissimilar Metal Procedure Qualification:

The 1995 Edition, ASME B&PV Code, Section XI, with the 1996 Addenda, IWA-4610(b), states:

"(b) The welding procedures and the welders or welding operators shall be qualified in accordance with Section IX and the additional requirements of this Subarticle."

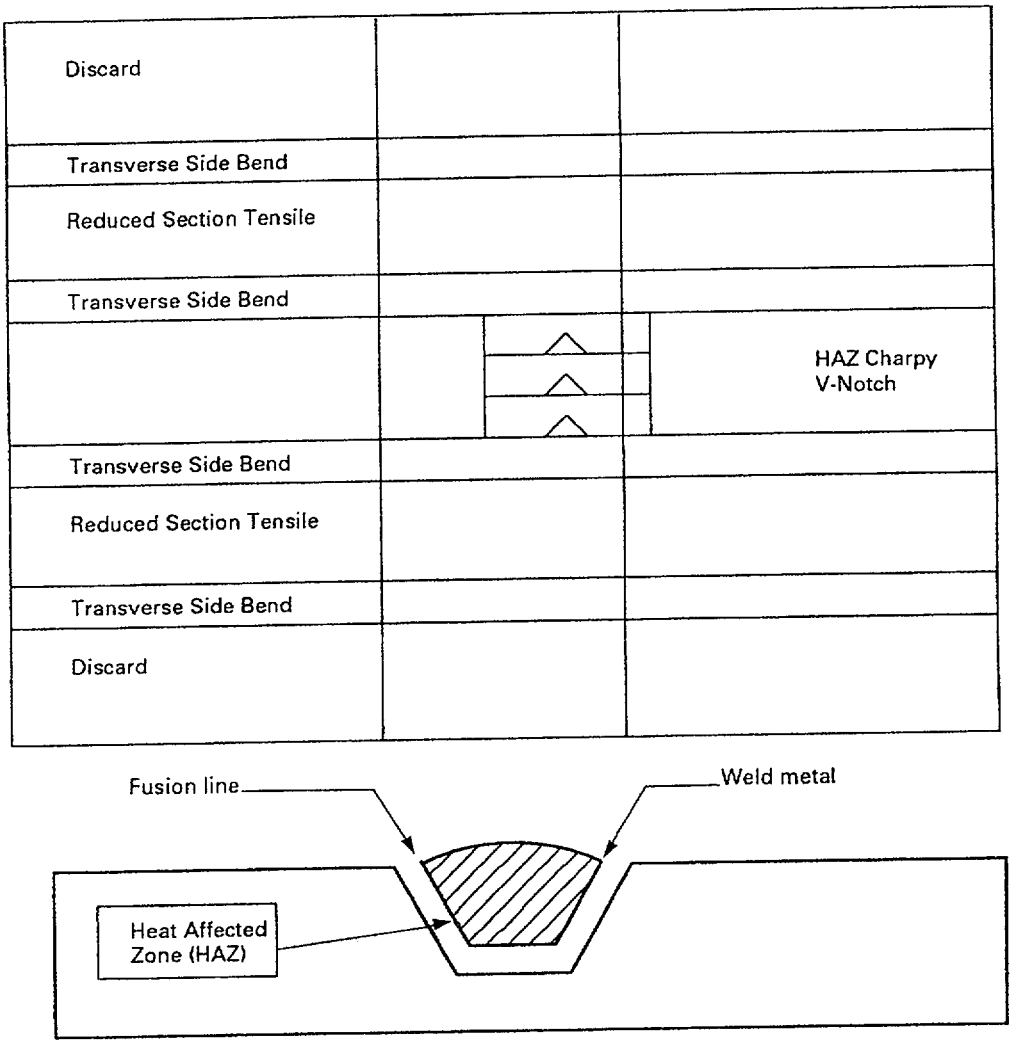
The reference to the requirements of Section IX leads to paragraph QW-424 and requires that each P-No. material in a dissimilar metal weld be welded to each other in the procedure qualification process. For this proposed alternative, a procedure qualification has been performed for welding P-No. 3 Group 3 base metal with F-No. 43 electrodes and P-No. 43 to P-No. 43 base metal with F-No. 43 electrodes which, when taken together, demonstrate that both sound welds and acceptable HAZ properties can be achieved by the proposed process.

6.2 Examination:

The final weld surface and the area (as appropriate for the applicable nondestructive examination method) adjacent to the weld shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. The ultrasonic examinations shall be in accordance with NB-5000 of reference (2).

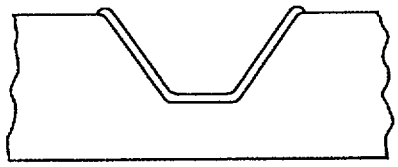
7.0 CONCLUSION:

The alternative provisions provided in this request to employ special temper bead technique requirements for repair welding of VHPs are acceptable for use by demonstrated technical adequacy based on the application of the methodology as it has been used in the industry and approved by the ASME in their acceptance of Code Case N-638. Based on this use and experience, DNC considers this alternative to provide an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).

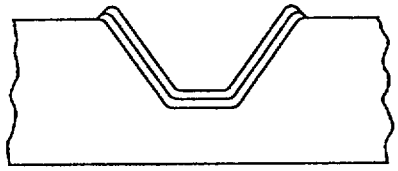


GENERAL NOTE: Base metal Charpy impact specimens are not shown. This figure illustrates a similar-metal weld.

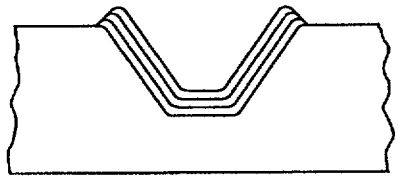
FIG. 1 QUALIFICATION TEST PLATE



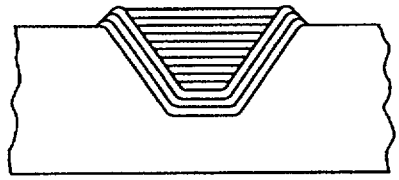
Step 1: Deposit layer one with first layer weld parameters used in qualification.



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.

FIG. 2 AUTOMATIC OR MACHINE (GTAW) TEMPER BEAD WELDING