May 8, 2008

Mr. David A. Christian
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 - RELIEF REQUEST RR-89-61 REGARDING THE USE OF WELD OVERLAYS AS AN ALTERNATIVE REPAIR AND MITIGATION TECHNIQUE (TAC NO. MD6965)

Dear Mr. Christian:

By letter dated October 4, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072780147), and revised by letter dated April 11, 2008 (ADAMS Accession No. ML081060130), Dominion Nuclear Connecticut, Inc. (the licensee), submitted the Request for Alternative RR-89-61 for Millstone Power Station, Unit No. 2 (MPS2). Specifically, the Relief Request seeks approval to use an alternative to the relevant requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, related to weld overlay repairs and preemptive type weld overlay applications for mitigation of primary water stress corrosion cracking.

The Nuclear Regulatory Commission (NRC) has reviewed the licensee's analysis in support of this Relief Request and has determined that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(a)(3)(i), the NRC staff authorizes the use of Request for Alternative RR-89-61, Revision 1, for the installation of full structural weld overlays on the dissimilar metal welds and adjacent similar metal welds identified in the enclosed safety evaluation during Cycle 18 and Cycle 19 refueling outages at MPS2. Request for Alternative RR-89-61, Revision 1, is subject to conditions identified in the enclosed safety evaluation. The effective period of Request for Alternative RR-89-61, Revision 1, is the third inservice inspection interval which ends on March 31, 2010.

If you have any questions, please contact John Hughey at (301) 415-3204.

Sincerely,

/ra/
Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336
cc w/encl: See next page

May 8, 2008

Mr. David A. Christian
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 - RELIEF REQUEST RR-89-61 REGARDING THE USE OF WELD OVERLAYS AS AN ALTERNATIVE REPAIR AND MITIGATION TECHNIQUE (TAC NO. MD6965)

Dear Mr. Christian:

By letter dated October 4, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072780147), and revised by letter dated April 11, 2008 (ADAMS Accession No. ML081060130), Dominion Nuclear Connecticut, Inc. (the licensee), submitted the Request for Alternative RR-89-61 for Millstone Power Station, Unit No. 2 (MPS2). Specifically, the Relief Request seeks approval to use an alternative to the relevant requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, related to weld overlay repairs and preemptive type weld overlay applications for mitigation of primary water stress corrosion cracking.

The Nuclear Regulatory Commission (NRC) has reviewed the licensee's analysis in support of this Relief Request and has determined that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(a)(3)(i), the NRC staff authorizes the use of Request for Alternative RR-89-61, Revision 1, for the installation of full structural weld overlays on the dissimilar metal welds and adjacent similar metal welds identified in the enclosed safety evaluation during Cycle 18 and Cycle 19 refueling outages at MPS2. Request for Alternative RR-89-61, Revision 1, is subject to conditions identified in the enclosed safety evaluation. The effective period of Request for Alternative RR-89-61, Revision 1, is the third inservice inspection interval which ends on March 31, 2010.

If you have any questions, please contact John Hughey at (301) 415-3204.

Sincerely,
/ra/

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

cc w/encl: See next page
DISTRIBUTION:

PUBLIC	LPL1-2 R/F	RidsNrrDorlLpl1-2
RidsNrrPMJHughey	RidsNrrLAABaxter	RidsRgn1MailCenter
RidsAcrsAcnw&mMailCenter	RidsOgcRp	RidsNrrPMMThorpe-Kavanaugh

ADAMS Accession No. ML081150692 *By memo dated 04/24/08

OFFICE	LPL1-2/PM	LPL1-2/PM	LPL1-2/LA	DCI/CPNB	OGC (NLO)	LPL1-2/BC
NAME	MThorpe-Kavanaugh	JHughey	ABaxter (SLittle for)	TChan*	LSubin	HChernoff
DATE	04/30/08	05/08/08	05/07/08	04/24/08	05/06/08	05/08/08

Official Record Copy

Millstone Power Station, Unit No. 2

cc:
Lillian M. Cuoco, Esquire
Senior Counsel
Dominion Resources Services, Inc.
Building 475, 5th Floor
Rope Ferry Road
Waterford, CT 06385

Edward L. Wilds, Jr., Ph.D.
Director, Division of Radiation
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

First Selectmen
Town of Waterford
15 Rope Ferry Road
Waterford, CT 06385

Charles Brinkman, Director
Washington Operations Nuclear Services
Westinghouse Electric Company
12300 Twinbrook Pkwy, Suite 330
Rockville, MD 20852

Senior Resident Inspector
Millstone Power Station
c/o U.S. Nuclear Regulatory Commission
P.O. Box 513
Niantic, CT 06357

Mr. J. Alan Price
Site Vice President
Dominion Nuclear Connecticut, Inc.
Building 475, 5th Floor
Rope Ferry Road
Waterford, CT 06385

Mr. J. W. "Bill" Sheehan
Co-Chair NEAC
19 Laurel Crest Drive
Waterford, CT 06385

Mr. Evan W. Woollacott
Co-Chair
Nuclear Energy Advisory Council
128 Terry's Plain Road
Simsbury, CT 06070

Ms. Nancy Burton
147 Cross Highway
Redding Ridge, CT 00870

Mr. Chris L. Funderburk
Director, Nuclear Licensing and
Operations Support
Dominion Resources Services, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

Mr. William D. Bartron
Licensing Supervisor
Dominion Nuclear Connecticut, Inc.
Building 475, 5th Floor
Rope Ferry Road
Waterford, CT 06385

Mr. Joseph Roy,
Director of Operations
Massachusetts Municipal Wholesale
Electric Company
Moody Street
P.O. Box 426
Ludlow, MA 01056

Mr. David A. Sommers
Dominion Resources Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

Mr. David A. Christian
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE RR-89-61

USE OF WELD OVERLAYS AS AN ALTERNATIVE REPAIR AND MITIGATION TECHNIQUE

MILLSTONE POWER STATION, UNIT NO. 2

DOMINION NUCLEAR CONNECTICUT, INC.

DOCKET NO. 50-336

1.0 INTRODUCTION

By letter dated October 4, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072780147), Dominion Nuclear Connecticut, Inc. (DNC or the licensee), submitted relief request (RR) RR-89-61 for Millstone Power Station, Unit No. 2 (MPS2), to allow the application of preemptive weld overlays (PWOLs) over 15 dissimilar and similar metal welds. The proposed approach is an alternative to the requirements of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, IWA-4000.

In response to the U.S. Nuclear Regulatory Commission (NRC) staff's request for additional information dated April 10, 2008 (ADAMS Accession No. ML080940352), the licensee submitted Request for Alternative RR-89-61, Revision 1, dated April 11, 2008 (ADAMS Accession No. ML081060130), hereinafter referred to as the licensee's proposed alternative. This safety evaluation is based on Revision 1 of the licensee's proposed alternative.

By letter dated April 17, 2008 (ADAMS Accession No. ML081140078), the licensee submitted Westinghouse reports entitled, "Millstone Unit 2 RCS [reactor coolant system] Surge, Spray, Shutdown Cooling, Safety Injection, Charging Inlet, and Letdown/Drain Nozzles Structural Weld Overlay Qualification (Proprietary and non-Proprietary)." The reports describe the geometries of the PWOLs, provide the technical basis for the application of the PWOLs, summarize the associated analyses, and provide the methodology used to demonstrate the acceptability of the PWOLs design qualifications.

The licensee's proposed alternative is designed to mitigate primary water stress-corrosion cracking (PWSCC) on dissimilar metal welds (DMWs) using full structural weld overlays at MPS2. The weld overlay will also be installed on the similar metal welds that are located adjacent to the DMWs to facilitate ultrasonic testing (UT) examination of the DMWs.

The licensee proposed the alternative for the current third inservice inspection (ISI) interval, which ends on March 31, 2010.

A DMW is a weld that joins two pieces of metal that are not of the same material. In the proposed alternative, the dissimilar metal weld joins the ferritic (i.e., carbon steel) nozzle to the safe end that is fabricated with either austenitic stainless steel or cast austenitic stainless steel. The DMW itself is made of nickel-based Alloy 82/182. The proposed preemptive weld overlay is a process by which weld filler metal that is resistant to stress corrosion cracking is deposited on the outside surface of the degraded pipe including the original pipe weld.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to requirements may be authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The code of record for MPS2 Repair/Replacement activities for the current third ISI interval is the 1998 Edition with No Addenda of the ASME Code, Section XI. In addition, as required by 10 CFR 50.55a, the licensee will use Appendix VIII, "Performance Demonstration for Ultrasonic Examinations," of the 1995 Edition through 1996 Addenda of the ASME Code, Section XI, for UT examination of the weld overlay.

3.0 LICENSEE'S PROPOSED ALTERNATIVE

The licensee has requested approval to use an alternative to the relevant requirements of the ASME Code, Section XI, related to weld overlay repairs and preemptive type weld overlay applications for mitigation of PWSCC.

3.1 ASME Code Components Affected

The licensee proposes to install a preemptive full structural weld overlay on the 15 DMWs and similar metal welds identified in Table 1, "Welds Affected by Request for Alternative RR-89-61, Revision 1."

TABLE 1: Welds Affected by Request for Alternative RR-89-61, Revision 1

Nozzle Type	Material Identification				
	Nozzle (carbon steel)	DMW weld	Safe end	ISI Weld (stainless steel)	Pipe/fitting
Hot Leg Surge Line, 12 inch NPS (1)	A-105, Gr 2 (P1)	BPS-C-1001	A-351, Gr CF8M (P8)	BPS-C-1003	A-351 GR CF8M (P8)
Hot Leg to SDC line, 12 inch NPS (1)	A-105, Gr. 2 (P1)	BSD-C-2001	A-351, Gr CF8M (P8)	BSD-C-2003	A-376, 316 (P8)
RCS Cold Leg SI Loop 1A, 12 inch NPS (2)	A-182, F1 (P3)	BSI-C-1001	A-351, Gr CF8M (P8)	BSI-C-1003	A-403 WP-316 (P8)
RCS Cold Leg SI Loop 1B, 12 inch NPS (1)	A-182, F1 (P3)	BSI-C-3000	A-351, Gr CF8M (P8)	BSI-C-3002	A-403 WP-316 (P8)
RCS Cold Leg SI Loop 2A, 12 inch NPS (1)	A-182, F1 (P3)	BSI-C-2001	A-351, Gr CF8M (P8)	BSI-C-2003	A-403 WP-316 (P8)
RCS Cold Leg SI Loop 2B, 12 inch NPS (2)	A-182, F1 (P3)	BSI-C-4000	A-351, Gr CF8M (P8)	BSI-C-4002	A-403 WP-316 (P8)
Hot Leg drain line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BPD-C-1001	SA-182, TP-316 (P8)	BPD-C-1003	A-376, 316 (P8)
RCS Cold Leg Charging Line, 2 inch NPS (1)	A-105, Gr.2 (P1)	BCH-C-1001	SA-182, TP-316 (P8)	BCH-C-1003	A-376, 316 (P8)
RCS Cold Leg Charging Line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BCH-C-2001	SA-182, TP-316 (P8)	BCH-C-2003	A-376, 316 (P8)
RCS Cold Leg Letdown Line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BPD-C-4000	SA-182, TP-316 (P8)	BPD-C-4002	A-376, 316 (P8)
RCS Cold Leg Spray Line, 3 inch NPS (1)	A-105, Gr.2 (P1)	BPY-C-1001	SA-182, TP-316 (P8)	BPY-C-1003	A-376, 316 (P8)
RCS Cold Leg Spray Line, 3 inch NPS (2)	A-105, Gr.2 (P1)	BPY-C-3000	SA-182, TP-316 (P8)	BPY-C-3002	A-376, 316 (P8)
RCS Cold Leg Drain Line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BPD-C-1017	SA-182, TP-316 (P8)	BPD-C-1019	A-376, 316 (P8)
RCS Cold Leg Drain Line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BPD-C-3000	SA-182, TP-316 (P8)	BPD-C-3002	A-376, 316 (P8)
RCS Cold Leg Drain Line, 2 inch NPS (2)	A-105, Gr.2 (P1)	BPD-C-2001	SA-182, TP-316 (P8)	BPD-C-2003	A-376, 316 (P8)

(1) PWOLs are planned to be installed on these welds during Cycle 18 refueling outage
(2) PWOLs are planned to be installed on these welds during Cycle 19 refueling outage, however if time and resources become available they could be moved up to Cycle 18 refueling outage

NPS = nominal pipe size; SDC = shutdown cooling; SI = Safety Injection

3.2 Code Requirements

The ASME Code, Section XI, 1998 Edition, no Addenda, IWA-4000 is used for the MPS2 repair/replacement program, which does not include the needed requirements for the weld overlay repair. By letter dated September 13, 1995 (ADAMS Accession No. ML052210033), the NRC staff approved the use of the 1998 Edition of the ASME Code.

The ASME Code requirements for which relief is requested are contained in the following: (1) 1998 Edition with no Addenda of the ASME Code, Section XI, IWA-4000; and (2) 1995 Edition with the 1996 Addenda of the ASME Code, Section XI, Appendix VIII, Supplement 11.

The ASME Code, Section XI, Table IWB-2500, Categories B-F and B-J, prescribes ISI requirements for Class 1 butt welds.

Appendix VIII, Supplement 11 of the ASME Code, Section XI, specifies performance demonstration requirements for UT examination of weld overlays.

3.3 Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposes the following as alternatives to the Code requirements specified above. The proposed alternatives are applicable to the 15 DMWs and adjacent stainless steel welds identified in Table 1 of this safety evaluation. The MPS2 tentative schedule calls for six PWOLs to be installed during Cycle eighteen (2R18) (spring 2008) and nine PWOLs to be installed during Cycle nineteen (2R19) refueling outages.

The licensee will install preemptive full structural weld overlays in accordance with the proposed requirements specified in Enclosure 1 of the licensee's proposed alternative. These requirements are based on the methodology of ASME Code, Section XI, Code Case N-740, "Dissimilar Metal Weld Overlay for Repair of Class 1, 2, and 3 Items, Section XI, Division 1." The requirements for design, fabrication, examination, pressure testing, and ISI of preemptive full structural weld overlays are described in Enclosure 1 of the licensee's proposed alternative. The requirements applicable to ambient temperature temper bead welding are described in Appendix I to Enclosure 1 of the licensee's proposed alternative. The ambient temperature temper bead welding will be applied to the welds as an alternative to the post-weld heat treatment requirements of the ASME Code, Section III.

The licensee stated that UT examinations of the proposed preemptive full structural weld overlays will be conducted in accordance with Appendix VIII, Supplement 11 of the 1995 Edition through 1996 Addenda of ASME Code, Section XI, utilizing alternatives to the Performance Demonstration Initiative (PDI) Program. The proposed PDI alternatives to Appendix VIII, Supplement 11 are specified in Enclosure 2 of the licensee's proposed alternative.

3.4 Duration Of Alternative

The licensee's proposed alternative is applicable to the third 10-Year Interval at MPS2. The licensee states that MPS2 is currently in the third 10-year ISI interval which began on April 1, 1999, and has been extended to end on March 31, 2010. The licensee intends to implement the request during refueling outages 2R18 and 2R19.

4.0 TECHNICAL EVALUATION

The licensee states that Request for Alternative RR-89-61, Revision 1, is based on Code Case N-740. Code Case N-740 combines the requirements in Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," and Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW [gas tungsten arc welding] Temper Bead Technique, Section XI, Division 1." The NRC staff has endorsed Code Cases N-504-3 and N-638-1 in Regulatory Guide (RG) 1.147, Revision 15, but not Code Case N-740. RG 1.147, as incorporated by reference into 10 CFR 50.55a(3)(b), identifies Code Cases with any identified limitations or modifications that the NRC has determined to be acceptable alternatives to applicable parts of Section XI. As identified in RG 1.147, Code Case N-504-3 is conditionally accepted stating that the provisions of Section XI, Appendix Q to the ASME Code must also be met. The staff evaluated the acceptability of Request for Alternative RR-89-61, Revision 1, based on the requirements of Code Cases N-504-3 and N-638-1. The NRC staff endorsed the use of N-504-3 in RG 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," during the same time period it was reviewing the MPS2 submittal. Therefore, some of the issues that the staff raised during the review of the licensee's submittal were based on N-504-2 and the discussion below will contain references to Code Case N-504-2 as well. The NRC staff notes that the licensee's submittal has considered the differences between Code Case Revisions N-504-2 and N-504-3.

The licensee has addressed many technical issues satisfactorily in the proposed alternative related to the design, analysis, and examination of the weld overlay that the NRC staff raised in its safety evaluation for ANO-1 relief request ANO1-R&R-010 and for Farley and Vogtle Relief Request ISI-GEN-ALT-06-03. Therefore, the staff evaluated herein only the following technical issues that are plant-specific to MPS2.

4.1 General Requirements

Section 1.0, "General Requirements," of Attachment 2 of the licensee's proposed alternative provides requirements for the specification of the base metal (carbon steel, stainless steel, and Alloy 82/182) and weld overlay filler metal (Alloy 52M), surface condition of the base metal, and chromium content of the weld overlay deposits. The proposed alternative is consistent with Codes Case N-504-3, Code Case N-638-1, and Appendix Q to the ASME Code, Section XI.

In the October 4, 2007, submittal, the licensee stated that it would apply a butter (transitional) layer of austenitic stainless steel filler metal across the austenitic stainless steel base metal. Paragraph (e) of Code Case N-504-3 requires specific delta ferrite content in the weld layer when austenitic stainless steel weld metal is used. The NRC staff asked the licensee to identify the austenitic stainless steel weld filler to be used for the transitional layer and confirm that the Certified Material Test Report for the filler wire shows a specified minimum delta ferrite number.

In the April 11, 2008, letter, the licensee responded that in the 2R18 outage the transitional layer application of the austenitic stainless steel filler metal will be ER 308/308L, with a delta ferrite number of 9FN. For the 2R19 outage, the austenitic stainless steel filler metal for the transitional layer will be qualified by the vendor and approved by DNC and will be either ER 308/308L or ER 309/309L with a delta ferrite content of 7.5 FN to 20 FN.

The licensee stated further that the transitional weld layer will be deposited with a welding procedure that has been qualified in accordance with the ASME Code, Section IX. Liquid penetrant examinations will be performed prior to deposition of the butter layer.

The NRC staff finds that the general requirements of the licensee's proposed alternative provide an acceptable level of quality and safety, as the licensee will deposit the transitional layer on the pipe and perform examination in accordance with the requirements of the ASME Code and Code Case N-504-3.

4.2 Crack Growth Considerations and Design

Section 2, "Crack Growth Considerations and Design," of Attachment 2 of the licensee's proposed alternative provides the requirements for weld overlay design, design-basis flaw size, and the crack-growth calculation. The crack-growth calculation assures that the growth of the crack in the base metal will be mitigated or minimized by the installation of the weld overlay. The Section 2 requirements are consistent with Code Case N-504-3 and Appendix Q to the ASME Code, Section XI. The significant issues are discussed below.

The licensee stated that the design basis for full structural weld overlays is to maintain the original design margins with no credit taken for the underlying PWSCC-susceptible weldments. The assumed design-basis flaw for the purpose of sizing the weld overlays is 360° and 100 percent through the original wall thickness of the DMWs. Regarding the crack-growth analysis for the preemptive full structural weld overlay, the licensee stated that a 100 percent through-wall flaw has been postulated for the crack growth calculations.

As part of the weld overlay design, the licensee will perform nozzle-specific stress analyses to establish a residual stress profile in each subject nozzle. Post-weld overlay residual stresses at normal operating conditions will be shown to result in beneficial compressive stresses on the inside surface of the components, assuring that further crack initiation due to PWSCC is highly unlikely.

The licensee will also perform fracture mechanics analyses to predict crack growth for postulated flaws. Crack growth due to PWSCC and fatigue will be analyzed for the original DMW. The analyses will demonstrate that the postulated cracks will not grow beyond the design basis for the weld overlays. The licensee will demonstrate that applying the weld overlay does not impact the conclusions of the existing stress reports. The stress and fatigue criteria of ASME Code, Section III, will be met for regions of the overlays remote from the assumed cracks.

The licensee will measure shrinkage during the overlay application. Shrinkage stresses at other locations in the piping systems arising from the weld overlays will be demonstrated not to have an adverse effect on the systems. Clearances of affected supports and restraints will be checked after the overlay repair, and will be reset within the design ranges as required. The licensee will evaluate the total added weight on the piping systems due to the overlays for potential impact on piping system stresses and dynamic characteristics. The as-built dimensions of the weld overlays will be measured and evaluated to demonstrate that they meet or exceed the minimum design dimensions of the overlays.

The NRC staff finds the crack growth considerations and design of the licensee's proposed alternative provide an acceptable level of quality and safety as the proposed analyses and

shrinkage measurement are consistent with paragraph (g) of Code Case N-504-3 and are, therefore, acceptable.

4.3 Examination and Inspection

Section 3, "Examination and Inspection," of Attachment 2 of the licensee's proposed alternative provides requirements for the acceptance examination, pre-service examination, and inservice examination after the weld overlay is installed. The length, surface finish, and flatness requirements of the weld overlay are specified in the weld overlay design to provide the required examination volume of the weld overlay as shown in Figures 1 and 2 of Attachment 2 of the licensee's proposed alternative.

4.3.1 Acceptance Examination

Section 3.0(a), "Acceptance Examination," of Attachment 2 of the licensee's proposed alternative requires a surface and UT examination of an installed weld overlay. The NRC staff finds the requirements of the acceptance examination acceptable because they are consistent with N-504-3 and Appendix Q to the ASME Code, Section XI.

4.3.2 Preservice Inspection

Section 3.0(b), "Preservice Inspection," of Attachment 2 of the licensee's proposed alternative requires an UT examination of the installed weld overlay and the upper (outer) 25 percent of the original pipe-wall thickness. The required examination volume is defined in Figure 2 of Attachment 2 of the proposed alternative. The NRC staff finds the preservice examination requirements acceptable because they are consistent with Code Case N-504-3 and the ASME Code, Section XI, Appendix Q.

4.3.3 Inservice Inspection

Section 3.0(c), "Inservice Inspection," of Attachment 2 of the licensee's proposed alternative requires inservice examination be conducted ultrasonically with the examination volume as defined in Figure 2 of the licensee's submittal. The requirements in Section 3.0(c) of Attachment 2 are consistent with the ASME Code, Section XI, Appendix Q with the exception discussed below.

In Section 4.3 of the licensee's proposed alternative, the licensee discussed the inspection issues regarding cast austenitic stainless steel (CASS) which was used to fabricate the safe ends of 6 of the DMWs identified for application of the PWOLs and the surge line similar metal weld identified in Section 3.1 above. The licensee stated and the NRC staff agrees that the UT examination has not been qualified in accordance with Appendix VIII, Supplement 11 of the ASME Code, Section XI, in the examination of CASS. The licensee stated further that a flaw with a depth of 100 percent of pipe thickness and circumference of 360 degrees will be assumed in the crack growth calculation for the cast stainless steel safe ends. The subject weld shall be ultrasonically inspected during the first or second refueling outage following the weld overlay installation per Section 3(c)(1) of Attachment 2 of the licensee's proposed alternative. After the first ISI examination, the required inspection volume shall be ultrasonically inspected every 10 years from the date of the installation until such time when UT is qualified to examine the CASS portion of the required inspection volume in accordance with new performance demonstration

requirements of ASME Code, Section XI, Appendix VIII. The inspection of the overlaid weld shall not be credited to satisfy the requirement of the 25 percent sample inspection every ten years of overlaid welds with non-CASS materials. After the subject weld is examined by qualified UT for the CASS material and no planar flaws are detected, the weld may be placed in the 25 percent sample inspection population per proposed relief request for Alternative RR-89-61, Revision 1, Section 3(c)(5).

The NRC staff notes that the licensee will perform UT examinations during the first or second refueling outage following weld overlay application per Section 3.0(c)(1), in addition to performing UT examinations every 10 years, pending qualified PDI techniques for CASS. The licensee further stated that until PDI procedures are qualified for CASS materials, it will perform "best effort" preservice and inservice inspections of the CASS components per the ASME Code, Section XI, Appendix VIII.

The NRC staff finds that the licensee's strategy for additional examination of CASS components provides an acceptable level of quality and safety, and is therefore, acceptable.

4.4 Proposed Ambient Temperature Temper Bead Welding

The requirements for the proposed ambient temperature temper bead welding are discussed in Attachment 2 of the licensee's proposed alternative and are based on Code Case N-638-1. The requirements in Attachment 2 of the proposed alternative are consistent with N-638-1, with one exception as discussed below.

Paragraph 1.0(a) of Code Case N-638-1 limits the maximum area of an individual weld to 100 square inches on the ferritic-base material using temper bead welding. However, the proposed alternative allows the weld surface area up to 500 square inches on the ferritic-base material. The technical justification for allowing weld overlays on ferritic materials with surface areas up to 500 square inches is provided in the ASME white paper supporting the changes in ASME Code Case N-638-3 and Electric Power Research Institute (EPRI) Report 1011898, "Justification for the Removal of the 100 Square Inch Temper Bead Weld Repair Limitation." The ASME white paper notes that the original limit of 100 square inches in Code Case N-638-1 was arbitrary. The white paper cites evaluations of a 12-inch diameter nozzle weld overlay to demonstrate adequate tempering of the weld heat affected zone, residual stress evaluations demonstrating acceptable residual stresses in weld overlays ranging from 100 to 500 square inches, and service history in which weld repairs exceeding 100 square inches were approved by the NRC and applied to DMW nozzles in several boiling-water reactor and pressurized-water reactor applications. Some of the cited repairs are greater than 15 years old, and have been inspected several times with no evidence of any continued degradation.

The above theoretical arguments and empirical data have been verified in practice by extensive field experience with temper bead weld overlays, with ferritic material coverage ranging from less than 10 square inches up to and including 325 square inches. It can be seen from the information provided in the EPRI Report and ASME white paper discussed above that the original DMW weld overlay was applied over 20 years ago, and weld overlays with low alloy steel coverage in the 100-square inch range have been in service for 5 to 15 years. Several overlays have been applied with low alloy steel coverage significantly greater than the 100 square inches. These overlays have been examined with PDI qualified techniques, in some cases multiple times, and none have shown any signs of new cracking or growth of existing cracks.

The NRC staff notes that the proposed 500-square-inch weld area has also been addressed in EPRI Report 1014351, “Repair and Replacement Applications Center: Topical Report Supporting Expedited NRC Review of Code Cases for Dissimilar Metal Weld Overlay Repairs, December 2006.” The technical basis for the 500-square-inch weld area was also presented in slides entitled, "Bases for 500 Square Inch Weld Overlay Over Ferritic Material," in an NRC-ASME public meeting held on January 10, 2007 (ADAMS Accession No. ML070470565). Based on EPRI Report 1014351, the staff finds that the proposed 500-square inch weld area on the ferritic material is acceptable because the stress analysis presented shows that the structural integrity of ferritic material is not adversely affected by a 500-square-inch weld overlay area.

4.5 PDI Program

Appendix VIII, Supplement 11 of the 1995 Edition through 1996 Addenda of ASME Code, Section XI, specifies requirements for performance demonstration of UT examination procedures, equipment, and personnel used to detect and size flaws in full structural overlays of wrought austenitic piping welds. The current UT examination technology cannot meet the requirements of Appendix VIII, Supplement 11. Therefore, the industry initiated the PDI Program as an alternative to satisfy the requirements of ASME Code, Section XI, Appendix VIII. To this end, EPRI has developed a program for qualifying equipment, procedures, and personnel in accordance with the UT criteria of Appendix VIII, Supplement 11. Prior to the Supplement 11 program, EPRI was maintaining a performance demonstration program (the precursor to the PDI program) for weld overlay qualification under the Tri-party Agreement with the NRC, BWR Owner’s Group, and EPRI, as discussed in the NRC letter dated July 3, 1984 (Nuclear Document System (NUDOCS) Accession No. 8407090122). Later, the NRC staff recognized the EPRI PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement in its letter dated January 15, 2002, to the PDI Chairman (ADAMS Accession No. ML020160532). The PDI program is assessed semi-annually by the staff for consistency with the current ASME Code and proposed changes.

The licensee has proposed to use the PDI program, as indicated in Enclosure 2 of the licensee’s proposed alternative, to satisfy the Appendix VIII, Supplement 11, qualification requirements. The PDI initiatives will be used for qualification of UT examinations to detect and size flaws in the preemptive full structural weld overlays of this request. The NRC staff evaluated the differences between the PDI program and Supplement 11 as shown in Enclosure 2 of the licensee’s proposed alternative. The NRC staff concludes that the justifications for the differences are acceptable and the PDI program provides an acceptable level of quality and safety. Therefore, the proposed MPS2 PDI program is acceptable for use in lieu of Supplement 11 of Appendix VIII to the ASME Code, Section XI.

4.6 Conditions of Request for Alternative RR-89-61, Revision 1

In Attachment 2 of the licensee's proposed alternative, the licensee agreed to the following conditions:

(1) The licensee will submit the following information to the NRC within 14 days from completing the final UT examinations of the completed weld overlays:

(a) Weld overlay examination results including a listing of indications detected and coverage limitations;
(b) Disposition of all indications using the standards of ASME Code, Section XI, IWB-3514-2 and/or IWB-3514-3 criteria and, if possible, the type and nature of the indications; and
(c) A discussion of any repairs to the weld overlay material and/or base metal and the reason for the repairs.

(2) Prior to entry into Mode 4 start-up from MPS2's 2R18 and 2R19 outages, the licensee will submit a preliminary stress analysis summary to the NRC as described in Paragraphs g(2) and g(3) of ASME Code Case N-504-3 demonstrating that the RCS piping nozzles will perform their intended design functions after the weld overlay installation. The stress analysis report will include results showing that the requirements of NB-3200 and NB-3600 of the ASME Code, Section III, are satisfied. The stress analysis will also include results showing that the requirements of IWB-3000 of the ASME Code, Section XI, are satisfied. The results will show that the postulated crack, including its growth in the nozzles, will not adversely affect the integrity of the overlaid welds. The final evaluation shall be submitted within 60 days of plant restart from the outage in which the PWOLs were installed.

(3) The licensee will perform a "best effort" preservice examination of the cast stainless steel region, following installation of the weld overlays during refueling outage 2R18 and 2R19.

(4) Until PDI procedures are qualified to examine the upper 25 percent of the cast stainless steel base material, DNC will perform "best effort" inservice inspections of the region shown in Figure 2 of Attachment 2 of the licensee's proposed alternative. Once qualified, the licensee will implement these PDI procedures. Inservice inspection of weld overlays for stainless steel welds is performed at the frequencies required by the MPS2 ISI Program as stipulated in Section 3.c of Attachment 2 of the licensee's proposed alternative.

The NRC staff finds that the above conditions are acceptable because the weld overlay examination results and stress analysis will provide verification of the condition of the weld overlays after installation. The NRC staff finds that the requirements of Request for Alternative RR-89-61, Revision 1, with the associated Enclosure 1 and 2 are consistent with the intent of the provisions of ASME Code Cases N-504-3 and N-638-1, and Appendices VIII and Q of ASME Code, Section XI. Therefore, the licensee's proposed alternative is acceptable.

5.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and determined that Request for Alternative RR-89-61, Revision 1, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of Request for Alternative RR-89-61, Revision 1, for the installation of full structural weld overlays on the DMWs and adjacent similar metal welds identified in Table 1 during 2R18 and 2R19 refueling outages at MPS2. Request for Alternative RR-89-61, Revision 1, is subject to the above stated conditions identified in Section 4.6. The effective period of Request for Alternative RR-89-61, Revision 1, is the third ISI interval which ends on March 31, 2010.

ASME Code, Section XI requirements for third-party review by the Authorized Nuclear Inservice Inspector remain applicable.

Principal Contributor: K. Hoffman

Date: May 8, 2008