



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

March 31, 2014

Mr. David A. Heacock  
President and Chief Nuclear Officer  
Dominion Nuclear Connecticut, Inc.  
Innsbrook Technical Center  
5000 Dominion Boulevard  
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 – ISSUANCE OF RELIEF  
REQUEST RR-04-15 REGARDING LIMITED ONE-SIDED ULTRASONIC  
EXAMINATION TECHNIQUE (TAC NO. MF1405)

Dear Mr. Heacock:

By letter dated April 9, 2013, as supplemented by letter dated February 7, 2014, Dominion Nuclear Connecticut, Inc. (the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) and proposed an alternative to the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Case N-770-1 "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated With UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities." The requested alternative applies to the fourth 10-year inservice inspection interval at Millstone Power Station, Unit 2 (MPS2).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the licensee requested to use the proposed alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

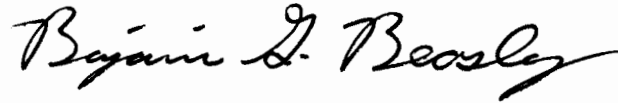
The NRC staff has determined that complying with the essentially 100 percent coverage requirements at MPS 2 would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The ultrasonic examinations described in the letter dated February 7, 2014 provide reasonable assurance of structural integrity and leak tightness of the subject components. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC authorizes the request for relief RR-04-15 for the fourth 10-year inservice inspection interval at MPS2, which began on April 1, 2010, and is scheduled to end on March 31, 2020.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

- 2 -

If you have any questions, please contact the Millstone Power Station Project Manager, Mohan Thadani, at (301) 415-1476.

Sincerely,

A handwritten signature in black ink, reading "Benjamin G. Beasley". The signature is fluid and cursive, with the first name "Benjamin" and last name "Beasley" clearly legible.

Benjamin G. Beasley, Chief  
Plant Licensing Branch I-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-336

Enclosure:  
As stated

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST RR-04-15

DOMINION NUCLEAR CONNECTICUT, INC.

MILLSTONE POWER STATION, UNIT NO. 2

DOCKET NUMBERS 50-336

1.0 INTRODUCTION

By letter dated April 9, 2013,<sup>1</sup> as supplemented by letter dated February 7, 2014,<sup>2</sup> Dominion Nuclear Connecticut, Inc. (the licensee) submitted alternative request RR-04-15. This request addressed eight cold leg dissimilar metal welds at Millstone Power Station Unit 2 (MPS2) and proposed an alternative to the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Case N-770-1 "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated With UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities." The requested alternative applies to the fourth 10-year inservice inspection interval at MPS2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the licensee requested to use the proposed alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

The licensee has requested relief from the requirements of ASME Code Case N-770-1 pursuant to 10 CFR 50.55a(a)(3)(ii).

The regulations in 10 CFR 50.55a(g)(6)(ii)(F) require that licensees of existing operating pressurized-water reactors (PWRs) implement the requirements of ASME Code Case N-770-1, subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii)(F)(2)-(10), by the first refueling outage after August 22, 2011.

Paragraph 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used when authorized by the Nuclear Regulatory Commission (NRC) if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of

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<sup>1</sup> Agencywide Document Access and Management System (ADAMS) Accession No. ML13108A008

<sup>2</sup> ADAMS Accession No. ML14051A109

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.

Based on analysis of the regulatory requirements, the NRC staff concludes that the NRC has the regulatory authority to authorize the proposed alternative under 10 CFR 50.55a(a)(3)(ii).

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee's Relief Request

##### Components Covered in RR-04-15

The relief request covers eight cold-leg ASME Code Class 1 reactor coolant pump inlet and outlet dissimilar metal welds. The welds are all approximately 3 inches thick, composed of 82/182 weld metal, and are between a cast austenitic stainless steel (CASS) CF8M safe end and a clad ferritic pipe or elbow. The welds are described in Table 1. Some information in Table 1 comes from a relief request dated September 27, 2007, (ADAMS Accession No. ML072750402).

Table 1: Welds Covered in RR-04-15

<b>Weld Number</b>	<b>Description</b>	<b>Outer Diameter</b>	<b>Weld Thickness</b>
P-4-C-1	Elbow to Safe-End	36 inches	3.08 inches
P-5-C-3	Safe-End to Pipe	36 inches	2.89 Inches
P-8-C-1	Elbow to Safe-End	36 inches	3.08 inches
P-9-C-3	Safe-End to Pipe	36 inches	2.89 Inches
P-13-C-1	Elbow to Safe-End	36 inches	3.08 inches
P-14-C-3	Safe-End to Pipe	36 inches	2.89 Inches
P-17-C-1	Elbow to Safe-End	36 inches	3.08 inches
P-18-C-3	Safe-End to Pipe	36 inches	2.89 Inches

##### Applicable Code Requirements

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 2004 Edition, no Addenda as amended by 10 CFR 50.55a is the code of record for MPS2, fourth 10-year inspection interval.

Paragraph 10 CFR 50.55a(g)(6)(ii)(F)(1), effective August 22, 2011, requires "licensees of existing, operating pressurized water reactors (as of July 21, 2011), shall implement the requirements of ASME Code Case N-770-1, subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (g)(6)(ii)(F)(10) of this section, by the first refueling outage after August 22, 2011."

Paragraph 10 CFR 50.55a(g)(6)(ii)(F)(4) states, "The axial examination coverage requirements of -2500(c) may not be considered to be satisfied unless essentially 100 percent coverage is achieved."

All welds in this relief request are classified under ASME Code Case N-770-1 as Category B "Unmitigated butt weld at cold leg operating temperature" welds. ASME Code Case N-770-1 Category B welds require bare metal visual examinations once per interval and essentially 100 percent volumetric examination for axial and circumferential flaws in accordance with the applicable requirements of ASME Section XI, Appendix VIII, every second inspection period not to exceed seven years.

#### Duration of the Proposed Relief

This alternative is requested for the fourth 10-year inservice inspection interval at Millstone Power Station Unit 2, which began on April 1, 2010, and is scheduled to end on March 31, 2020.

#### Proposed Alternative

The licensee is proposing to perform ultrasonic examinations in accordance with ASME Code Case N-770-1 to the maximum extent possible. All scans are to be performed using phased array ultrasonic search units and the data will be spatially encoded. The details of the proposed scans are given in Table 2. The expected coverage for the ferritic steel and alloy 182 weld metal is given in Table 3.

Table 2: Encoded Phased Array Scanning Methods for Use in Proposed Examinations

Scan	Qualified For	Refracted Angles and Modes
Axial Raster Scan for Circumferential Flaws	Detection and Length Sizing	30°, 37.5°, 45°, 52.5°, and 60° refracted longitudinal wave
Axial Raster Scan for Circumferential Flaws	Detection and Length Sizing	45°, 52.5°, and 60° refracted shear wave
Axial Raster Scan for Circumferential Flaws	Depth Sizing	30°, 45°, 52°, 60°, and 70° refracted longitudinal wave
Circumferential Raster Scan for Axial Flaws	Detection and Depth Sizing	25°, 35°, 45°, and 55° refracted longitudinal wave, skewed -30° to 30° with a 2.5° resolution

Table 3: Expected Code Coverage for the Combined Ferritic Steel and Alloy 182/82 Weld Metal

Weld Number	Description	Axial Beam (%)	Circ. Beam (%)	Wetted Surface Coverage
P-4-C-1	Elbow to Safe-End	100	83.5	100
P-5-C-3	Safe-End to Pipe	100	100	100
P-8-C-1	Elbow to Safe-End	100	83.5	100
P-9-C-3	Safe-End to Pipe	100	100	100
P-13-C-1	Elbow to Safe-End	100	83.5	100
P-14-C-3	Safe-End to Pipe	100	100	100
P-17-C-1	Elbow to Safe-End	100	83.5	100
P-18-C-3	Safe-End to Pipe	100	100	100

While code coverage cannot be claimed for the CASS material, a "Best Effort" examination will be performed on the CASS safe ends. Table 4 details the expected "Best Effort" coverage for the CASS safe end material.

Table 4: Expected Best Effort Coverage for Cast Safe End Material

Weld Number	Axial Beam (%)	Circ. Beam (%)
P-4-C-1	100	0
P-5-C-3	100	99
P-8-C-1	100	0
P-9-C-3	100	99
P-13-C-1	100	0
P-14-C-3	100	99
P-17-C-1	100	0
P-18-C-3	100	99

#### Basis for Relief

The welds covered by this request are located in the cold leg temperature regions of the RCS where there is a reduced probability of crack initiation, and a reduced crack growth rate. Operating experience has not identified cracking in these specific large diameter pipe welds.

The welds covered in RR-04-15 were examined during the last interval using non-encoded conventional ultrasonic techniques. For the upcoming scheduled examinations, the licensee plans to use phased-array ultrasonic techniques. The use of phased array UT is not expected to significantly increase the examination volume coverage from the previous examinations due to the inherent access limitations of the weld configurations. The expected volumetric coverage

includes a large percentage of the Primary Water Stress Corrosion Crack (PWSCC) susceptible material and the wetted surface of the susceptible material.

### 3.2 Staff Evaluation

The staff reviewed the licensee's proposed alternative under the requirements of 10 CFR 50.55a(a)(3)(ii). The safe end to pipe and safe end to elbow welds described in Table 1 are dissimilar metal welds made with the nickel alloy 82/182 which is known to be susceptible to primary water stress corrosion cracking. These dissimilar metal welds are covered by ASME Code Case N-770-1, which was developed in response to the rapid propagation of PWSCC in 82 and 182 weld metals. The use of ASME Code Case N-770-1 is required by 10 CFR 50.55a(g)(6)(ii)(F). As the safe ends are constructed of CASS, obtaining essentially 100 percent coverage would require replacement of the 36-inch diameter CASS safe ends with a different material, which would impose a hardship on the licensee.

The welds are to be examined using a series of encoded phased array ultrasonic examinations using shear and longitudinal angles between 25 and 60 degrees for flaw detection. These examinations will achieve 100 percent coverage for circumferential flaws in the alloy 82/182 weld metal and either 100 percent or 83.5 percent coverage for axial flaws. The entire wetted surface of the alloy 82/182 weld metal will be examined from both the axial and circumferential directions. The expected coverage using encoded phased array ultrasonic techniques provides reasonable assurance that stress corrosion cracks would be found if they are present and reasonable assurance of the leak tightness and structural integrity of the ferritic pipes and elbows and the nickel alloy weld metals.

The same techniques being used to examine the weld metal will be used to examine the cast safe end material as a "Best Effort" inspection. Based on the results of NUREG-6933 these inspections can, at best, be expected to find cracks of 30-40 percent through wall. Operational experience with CASS materials has shown that they are not vulnerable to stress corrosion cracking. The combination of the planned inspections and resistant nature of the CASS material provides reasonable assurance of structural integrity and leak tightness of the CASS safe end material.

As stated above, the expected examination coverage of the eight welds for circumferential and axial cracks provides reasonable assurance of structural integrity for the welds. Given this reasonable assurance and the hardship that would be imposed by requiring a redesign and replacement of the eight components, RR-04-15 meets the requirements of 10 CFR 50.55a(a)(3)(ii).

### 4.0 CONCLUSIONS

As set forth above, the NRC staff has determined that complying with the essentially 100 percent coverage requirements at Millstone Power Station Unit 2 would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The ultrasonic examinations described in the letter dated February 7, 2014, provide reasonable assurance of structural integrity and leak tightness of the subject components. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC authorizes the request for

relief No. RR-04-15 for the fourth 10-year inservice inspection interval at Millstone Power Station Unit 2, which began on April 1, 2010, and is scheduled to end on March 31, 2020.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Stephen Cumblidge

Date: March 31, 2014



If you have any questions, please contact the Millstone Power Station Project Manager, Mohan Thadani, at (301) 415-1476.

Sincerely,

*/ra/*

Benjamin G. Beasley, Chief  
Plant Licensing Branch I-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-336

Enclosure:  
As stated

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**ADAMS ACCESSION NO.: ML14063A578**

**\*See memo dated February 28, 2014**

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