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

July 13, 2016

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 – RELIEF REQUESTS FOR LIMITED COVERAGE EXAMINATIONS PERFORMED IN THE FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL (CAC NOS. MF6567, MF6568, AND MF6569)

Dear Mr. Heacock:

By letter dated July 30, 2015, as supplemented by letters dated December 18, 2015, April 21, 2016, and May 20, 2016, Dominion Nuclear Connecticut, Inc. (the licensee), submitted Relief Request RR-04-17, RR-04-18, and RR-04-19, which requested relief from the volumetric examination coverage requirements pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(g)(5)(iii) on the basis that the required examination coverage was impractical due to physical obstructions and limitations imposed by design, geometry and materials of construction of the subject components for the Millstone Power Station, Unit No. 2 (MPS2). The relief is requested for the fourth 10-year inservice inspection (ISI) interval for MPS2, which began on April 1, 2010 and will end on March 31, 2020.

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the licensee's subject relief requests for MPS2. Pursuant to 50.55a(g)(6)(i), the NRC staff has determined that it is impractical for the licensee to comply with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME) Code, Section XI requirement; that the proposed examinations performed to the extent practical provides reasonable assurance of structural integrity and leak tightness of the subject welds; and that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants relief for the subject examinations of the components contained in Relief Requests RR-04-17, RR-04-18, and RR-04-19 for the fourth 10-year ISI interval at MPS2.

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

If you have any questions, please contact the project manager, Richard Guzman, at (301) 415-1030 or Richard.Guzman@nrc.gov.

Sincerely,

Douglas V Pickett for

Travis L. Tate, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# RELIEF REQUESTS FOR LIMITED COVERAGE EXAMINATIONS

# PERFORMED IN THE FOURTH 10-YEAR INSPECTION INTERVAL

# DOMINION NUCLEAR CONNECTICUT, INC.

# MILLSTONE POWER STATION, UNIT NO. 2

# DOCKET NO. 50-336

## 1.0 INTRODUCTION

By letter dated July 30, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15216A359), as supplemented by letter dated December 18, 2015 (ADAMS Accession No. ML15358A005), April 21, 2016 (ADAMS Accession No. ML16117A260), and May 20, 2016 (ADAMS Accession No. ML16148A701), Dominion Nuclear Connecticut, Inc. (the licensee), submitted Relief Requests (RR) RR-04-17, RR-04-18, and RR-04-19 from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 2004 Edition, under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(5)(iii), for limited coverage examinations performed in the first inspection period of the fourth 10-year inservice inspection (ISI) interval for Millstone Power Station, Unit 2 (MPS2). Specifically, pursuant to 50.55a(g)(5)(iii), the licensee requested relief on the basis that the required examination coverage was impractical due to physical obstructions and limitations imposed by design, geometry and materials of construction of the subject components.

## 2.0 REGULATORY REQUIREMENTS

Pursuant to 10 CFR 50.55a(g)(4), the ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for In-service 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, which was incorporated by reference in 10 CFR 50.55a(a) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed in 10 CFR 50.55a (b)(2).

Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with the ASME Code requirement is impractical for its facility, the licensee must notify the Nuclear Regulatory Commission (NRC) and submit, as specified in 10 CFR 50.4, information to support the determinations. Pursuant to 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations under paragraph (g)(5) of 10 CFR 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, and will not endanger life or property or the common defense and security, and are otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The licensee has requested relief from ASME Code requirements pursuant to 10 CFR 50.55a(g)(5)(iii). Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request, and the NRC to grant, the relief requested by the licensee.

## 3.0 TECHNICAL EVALUATION

### 3.1 Relief Request RR-04-17 ASME Section XI, Examination Category B-D Full Penetration Welded Nozzles in Vessels Inspection Program B

ASME Code Components Affected

| | |
|---|---|
| ASME Code Class: | Code Class 1 |
| Exam Category: | B-D, Full Penetration Welded Nozzles in Vessels – Inspection Program B |
| Item Numbers: | B3.130, Steam Generator (Primary Side), Nozzle-to-Vessel Welds |
| Weld Identification: | SG-2-NH-2-A, 30" Cold Leg Nozzle to Hemisphere |
| | SG-2-NH-4-A, 42" Hot Leg Nozzle to Hemisphere |
| | SG-2-NH-5-A, 30" Cold Leg Nozzle to Hemisphere |

Applicable Code Edition and Addenda

The code of record for the fourth 10-year ISI interval is the 2004 Edition, no Addenda of the ASME Code.

Duration of Relief Request

The licensee submitted this relief request for the fourth 10-year ISI interval which started on April 1, 2010, and ends on March 31, 2020.

ASME Code Requirements

ASME Code, Section XI, 2004 Edition, Examination Category B-D, requires 100 percent volumetric examination coverage of the weld volume as defined in Table IWB-2500-1 and shown in Figure IWB-2500-7.

ASME Code, Section XI, 2004 Edition, Examination Category B-P, requires system leakage tests of all pressure retaining components with a visual (VT-2) examination in accordance with IWA-5240 and acceptance standards in accordance with IWB-3522.

ASME Code Case N-460, Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1, as approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, Section XI, Division 1," states that a reduction in examination coverage due to part geometry or interference for any ASME Class 1 or 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

ASME Code, Section XI, 2004 Edition, Mandatory Appendix I, Article I-2120, requires that ultrasonic examination of vessels other than reactor vessels and which are greater than 2 inches in thickness shall be conducted in accordance with Article 4 of Section V, as supplemented by Table I-2000-1.

Licensee's Request for Relief

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that compliance with the ASME Code requirement is impractical. The licensee stated that limitations imposed by the nozzle configuration preclude obtaining 100 percent coverage for the above referenced steam generator nozzle-to-vessel welds. The licensee further clarified that the nozzle configuration prevents complete scanning in the vicinity of the nozzle outside radius due to lift-off of the search unit resulting in a loss of contact between the search unit and the component. The licensee stated that no alternative techniques or advanced technologies were considered capable of obtaining complete coverage of the examination volume. The licensee concluded that to increase examination coverage on the subject welds would require a significant design modification or replacement of components with a different design to eliminate the obstructions, and that such modification or replacement would be impractical due to cost, additional radiation exposure, and impact to plant equipment.

The licensee stated that the subject welds received a volumetric examination using the best available techniques on the accessible portions of welds to the extent practical. The examination coverages and results as documented in the licensee's request are as follows:

Table 1: Examination Category B-D Welds Summary of Results

| Weld Number | Coverage percent (%) | Results |
|---|---|---|
| SG-2-NH-2-A | 73.3% | No recordable indications |
| SG-2-NH-4-A | 72.5% | No recordable indications |
| SG-2-NH-5-A | 72.4% | No recordable indications |

Additionally, the licensee stated that a VT-2 visual examination is performed at the end of each refueling outage during the system leakage tests as required by the ASME Code for Table IWB-2500-1, Category B-P components.

NRC Staff Evaluation

As described in the licensee's submittal, the examinations of the steam generator nozzle-to-vessel welds are limited by the geometry and configuration of the nozzles in the vicinity of the outside radius which results in a loss of contact between the search unit and the component. The licensee examined these welds using 0-degree longitudinal waves and 30-degree, 45-degree, and 60-degree shear waves and achieved an examination coverage of greater than 72 percent for these welds. No recordable indications were detected.

The ASME Code requires 100 percent volumetric examination of the Category B-D nozzle-to-vessel welds. However, the geometry and configuration of the nozzles limit access for ultrasonic scanning. In order to effectively increase the scanning coverage, the nozzle-to-vessel welds would require design modifications. The NRC staff determined that this would place a burden on the licensee. Therefore, obtaining 100 percent volumetric examination of the nozzle-to-vessel welds would be impractical.

Because the licensee's submittal did not provide the ASME Code procedure for performing these ultrasonic examinations, NRC staff issued a request for additional information (RAI) for the licensee to provide the non-destructive examination procedure used to perform the ultrasonic examinations for this relief request. In its response to the RAI in letter dated December 18, 2015, the licensee clarified that for all the examinations referenced in relief request RR-04-17, the ultrasonic examination procedure was written in accordance with ASME Section XI, Appendix I and Section V, Article 4. The staff finds the licensee's response acceptable, since the ultrasonic examination procedure is in accordance with the requirements of ASME Code, Section XI, Mandatory Appendix I, Article I-2120, for ultrasonic examination of vessels other than reactor vessels and which are greater than 2 inches in thickness.

The licensee's submittal also states that the VT-2 visual examination required by the ASME Code for Category B-P pressure retaining components is a factor in their conclusion that service induced degradation would be detected. Table IWB-2500-1 requires a system leakage test for all Category B-P pressure retaining components every refueling outage. The VT-2 visual examination specified in Table IWB-2500-1 and IWA-5240 for these leakage tests requires, in part, that:

- Accessible external exposed surfaces be examined for evidence of leakage
- The surrounding areas of inaccessible surfaces be examined for evidence of leakage
- Remote visual equipment or installed leakage detection systems may be used for inaccessible areas

The acceptance criteria specified in Table IWB-2500-1 and IWB-3522 for these leakage tests requires, in part, that:

- corrective action be taken for identified leakage (unless within defined permissible limits), and
- determination of the source of leakage from insulated or inaccessible components.

Based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant

service-induced degradation was present in these welds, evidence would have been detected by the examinations performed. Based on operational experience and the extent to which the examinations were performed, the staff has determined there is reasonable assurance that the structural integrity of these welds will be maintained throughout the fourth 10-year interval ISI program.

3.2 Relief Request RR-04-18 ASME Code, Section XI, Examination Category C-A, Pressure Retaining Welds in Pressure Vessels

ASME Code Components Affected

| | |
|---|---|
| ASME Code Class: | Code Class 2 |
| Exam Category: | C-A, Pressure Retaining Welds in Pressure Vessels |
| Item Numbers: | C1.10, Shell Circumferential Welds<br>C1.30, Tubesheet-to-Shell Welds |
| Weld Identification: | SIAC-A1, Shutdown Cooling Heat Exchanger Tubesheet-to-Shell Weld (Item #C1.30)<br>SIAC-A2, Shutdown Cooling Heat Exchanger Flange to Shell Weld (Item #C1.10) |

Applicable Code Edition and Addenda

The code of record for the fourth 10-year ISI interval is the 2004 Edition, no Addenda of the ASME Code.

Duration of Relief Request

The licensee submitted this relief request for the fourth 10-year ISI interval which started on April 1, 2010, and ends on March 31, 2020.

ASME Code Requirement

ASME Code, Section XI, 2004 Edition, Examination Category C-A, requires 100 percent volumetric examination coverage of the weld volume as defined in Table IWC-2500-1 and shown in Figures IWC-2500-1 and -2500-2.

ASME Code, Section XI, 2004 Edition, Examination Category C-H, requires system leakage tests of all pressure retaining components with VT-2 visual examination in accordance with IWA-5240 and acceptance standards in accordance with IWC-3516.

ASME Code Case N-460, Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1, as approved for use by the NRC in RG 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, Section XI, Division 1," states that a reduction in examination coverage due to part geometry or interference for any ASME Class 1 or 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

ASME Code, Section XI, 2004 Edition, Mandatory Appendix I, Article I-2210, requires that ultrasonic examination of vessels not greater than 2 inches in thickness shall be conducted in accordance with Appendix III as supplemented by Table I-2000-1.

Licensee's Request for Relief

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that compliance with the ASME Code requirement is impractical. The licensee stated that the tube sheet flange is located within close proximity of weld SIAC-A1 and that this restricts the axial scan coverage that can be obtained for weld SIAC-A1. The licensee also stated that the channel cover flange is located within close proximity of weld SIAC-A2 and that this restricts the axial and circumferential coverage that can be obtained for weld SIAC-A2. The licensee stated that no alternative techniques or advanced technologies were considered capable of obtaining complete coverage of the examination volume for these welds. The licensee concluded that to increase examination coverage on the subject welds would require a significant design modification or replacement of components with a different design to eliminate the obstructions, and that such modification or replacement would be impractical due to cost, additional radiation exposure, and impact to plant equipment.

The licensee stated that the subject welds received a volumetric examination using the best available techniques on the accessible portions of welds to the extent practical. The examination coverages and results as documented in the licensee request are as follows:

Table 2: Examination Category B-D Welds Summary of Results

| Weld Number | Coverage Percent (%) | Results |
|---|---|---|
| SIAC-A1 | 81.5% | One recordable indication (acceptable root geometry) |
| SIAC-A2 | 63.8% | No recordable indications |

Additionally, the licensee stated that a VT-2 visual examination is performed at the end of each refueling outage during the system leakage tests as required by the ASME Code for Table IWC-2500-1, Category C-H components.

NRC Staff Evaluation

As described in the licensee's submittal, the close proximity of the shutdown cooling heat exchanger tube sheet flange to the weld does not provide enough distance to allow scanning of that side of the tube sheet-to-shell weld. The licensee performed the examination of the tube sheet-to-shell weld using 45-degree and 60-degree shear waves and achieved an examination coverage of 81.5 percent. There was one recordable indication for the tube sheet-to-shell weld, but it was evaluated to be acceptable root geometry. Also, as described in the licensee's submittal, the close proximity of the channel cover flange to the weld does not provide enough distance to allow scanning of that side of the channel cover flange-to-shell weld. The licensee performed the examination of the channel cover flange-to-shell weld

using 45-degree and 60-degree shear waves and achieved an examination coverage of 63.8 percent. No recordable indications were detected for the flange to shell weld.

The ASME Code requires 100 percent volumetric examination of the Category C-A pressure retaining welds in pressure vessels. However, the geometry and configuration of these welds limits access for ultrasonic scanning. In order to effectively increase the scanning coverage, these welds would require design modifications. The staff determined that this would place a burden on the licensee. Therefore, obtaining 100 percent volumetric examination of these welds would be impractical.

Because the licensee's submittal did not provide the ASME Code procedure for performing these ultrasonic examinations, NRC staff issued an RAI for the licensee to provide the non-destructive examination procedure used to perform the ultrasonic examinations for this relief request. In its response to the RAI in letter dated December 18, 2015, the licensee clarified that for all the examinations referenced in relief request RR-04-18, the ultrasonic examination procedure was written in accordance with ASME Section XI, Appendix I and Appendix III. The staff finds the licensee's response acceptable, since the ultrasonic examination procedure is in accordance with the requirements of ASME Code, Section XI, Mandatory Appendix I, Article I-2120, for ultrasonic examination of vessels not greater than 2 inches in thickness.

The licensee's submittal also states that the VT-2 visual examination required by the ASME Code for Category C-H pressure retaining components is a factor in their conclusion that service induced degradation would be detected. Table IWC-2500-1 requires a system leakage test for all Category C-H pressure retaining components every refueling outage. The VT-2 visual examination specified in Table IWC-2500-1 and IWA-5240 for these leakage tests requires, in part, that:

- Accessible external exposed surfaces be examined for evidence of leakage
- The surrounding areas of inaccessible surfaces be examined for evidence of leakage
- Remote visual equipment or installed leakage detection systems may be used for inaccessible areas

The acceptance criteria specified in Table IWC-2500-1 and IWC-3516 for these leakage tests requires, in part, that:

- corrective action be taken for identified leakage (unless within defined permissible limits), and
- determination of the source of leakage from insulated or inaccessible components.

Based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present in these welds, evidence would have been detected by the examinations performed. Based on operational experience and the extent to which the examinations were performed, the staff has determined there is reasonable assurance that the structural integrity of these welds will be maintained throughout the fourth 10-year interval ISI program.

3.3 Relief Request RR-04-19 ASME Code, Section XI, Examination Category R-A, Risk Informed Piping Examinations

ASME Code Components Affected

| | |
|---|---|
| ASME Code Class: | Code Class 1 |
| Exam Category: | R-A, Risk Informed Piping Examinations |
| Item Numbers: | R1.11, Elements Subject to Thermal Fatigue |
| | R1.20, Elements Not Subject to a Damage Mechanism |
| Weld Identification: | BPY-C-5019-A, Charging / Class 1 |
| | BSI-C-3004, Safety Injection / Class 1 |
| | BPY-C-1063-A, Reactor Coolant / Class 1 |
| | BPY-C-1065-A, Reactor Coolant / Class 1 |
| | BPY-C-3070-A, Reactor Coolant / Class 1 |
| | BPY-C-3072-A, Reactor Coolant / Class 1 |

Applicable Code Edition and Addenda

The code of record for the fourth 10-year ISI interval is the 2004 Edition, no Addenda of the ASME Code.

Duration of Relief Request

The licensee submitted this relief request for the fourth 10-year ISI interval which started on April 1, 2010, and ends on March 31, 2020.

ASME Code Requirements

The examination requirements for Class 1 and 2 piping welds are governed by the Risk Informed Inservice Inspection program that was approved by the NRC in letter dated March 27, 2012 (ADAMS Accession No. ML120800433). Examination Category R-A requires essentially 100 percent volumetric examination. "Essentially 100 percent", as clarified by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," is greater than 90 percent coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 16, "Inservice Inspection Code Case Acceptability."

Components for Which Relief is Requested

Table 3: Examination Category R-A Welds with Limited Volumetric Coverage

| Code Item | Weld ID | Configuration | Materials | Pipe Size (in.) | Coverage Obtained (%) |
|---|---|---|---|---|---|
| R1.11 | BPY-C-5019-A | 4" Pipe-to-Tee | Pipe – SA376 TP316<br>Tee – SA403 WP316<br>Filler – ER316 | 4.0 | 82.5 |

| Code Item | Weld ID | Configuration | Materials | Pipe Size (in.) | Coverage Obtained (%) |
|---|---|---|---|---|---|
| R1.11 | BSI-C-3004 | Pipe-to-Elbow | Pipe – SA376 TP316<br>Elbow – A403 WP316<br>Filler – ER308L | 12.0 | 90 |
| R1.20 | BPY-C-1063-A | Pipe-to-Valve | Pipe – SA376 TP316<br>Valve – SA182 F316<br>Filler – ER316L | 3.0 | 50 |
| R1.20 | BPY-C-1065-A | Pipe-to-Valve | Pipe – SA376 TP316<br>Valve – SA182 F316<br>Filler – ER316L | 3.0 | 50 |
| R1.20 | BPY-C-3070-A | Pipe-to-Valve | Pipe – SA376 TP316<br>Valve – SA182 F316<br>Filler – ER316L | 3.0 | 50 |
| R1.20 | BPY-C-3072-A | Pipe-to-Valve | Pipe – SA376 TP316<br>Valve – SA182 F316<br>Filler – ER316L | 3.0 | 50 |

Reason for Request and Proposed Alternative

The licensee stated that the subject welds were examined with a manual pulse echo ultrasonic testing (UT) and search unit to achieve the maximum examination coverage practical. Examinations were performed using personnel, equipment and procedures qualified in accordance with ASME Section XI, Appendix VIII, as implemented by the Performance Demonstration Initiative (PDI). The licensee indicated that the subject welds are austenitic stainless steel and there are currently no PDI qualified single-side examination procedures that demonstrate equivalency to two-sided examination on austenitic piping welds. The ASME code required volume of these welds was interrogated ultrasonically to the maximum extent possible. The licensee also stated that no alternative techniques or advanced technologies were considered capable of obtaining complete coverage of the examination volume.

The licensee stated that examinations of subject welds BPY-C-1063-A, BPY-C-1065-A, BPY-C-3070-A, and BPY-C-3072-A were performed as pre-service examinations of new piping welds associated with valve replacements. The licensee also stated that these welds consist of pipe-to-valve configurations where the taper of the valve is within close proximity of the weld, and there is not sufficient distance between the weld and valve to perform any circumferential or axial scanning on that side of the weld. Supplemental scanning was performed to provide a non-code best effort examination, though credit for UT coverage can only be claimed as 50 percent. In addition, the licensee stated that liquid penetrant surface examinations and radiographic examinations were performed on each weld with 100 percent coverage.

The licensee stated that the subject weld BPY-C-5019-A consists of a pipe-to-tee where the radius of the tee is within close proximity of the weld and does not provide sufficient distance from the tee to the weld to perform complete axial scanning on this side of the weld. Examination in the area of the radius of the tee is limited to axial scanning from the pipe side only. Supplemental scanning was performed to provide a non-code best effort examination,

though credit for UT coverage can only be claimed as 82.5 percent. In addition, the licensee notes that there were six other selected welds within the charging system susceptible to the same degradation mechanism, which had examinations with 100 percent coverage obtained.

The licensee stated that the subject weld BSI-C-3004 consists of a pipe-to-elbow where there is a weld overlay on an adjacent weld that extends to within close proximity of the subject weld and does not provide sufficient distance between the weld overlay and elbow side of the weld to perform complete axial scanning on the elbow side of the weld. Examination in the area of the elbow restricted by the weld overlay is limited to axial scanning from the pipe side only. Supplemental scanning was performed to provide a non-code best effort examination, though credit for UT coverage can only be claimed as 90.0 percent. In addition, the licensee notes that there were four other selected welds within the safety injection system susceptible to the same degradation mechanism, which had examinations with 100 percent coverage obtained.

The licensee's ultrasonic scanning techniques included combinations of 45-, 60-, and 70-degree shear, and/or 60-degree refracted longitudinal waves (L-waves), as applicable, for ASME Code, Class 1 piping welds listed in Table 3, from the accessible side of the welds. One indication was detected on the Charging system pipe-to-tee Weld BPY-C-5019-A. The licensee stated that the indication was evaluated as acceptable inner-diameter root geometry.

NRC Staff Evaluation

Applicable to all of the subject connections, Code Case N-716, Table 3, Examination Category R-A, requires essentially 100 percent volumetric and surface examinations. However, complete volumetric examinations are restricted by component design, materials and weld configurations. These conditions preclude the licensee from obtaining full volumetric examinations from both sides of these welds. To gain access for examination, the welds would require design modifications. The staff determined that this would place a burden on the licensee; thus, obtaining 100 percent of ASME Code-required volumetric examinations is considered impractical.

The subject Class 1 austenitic stainless steel welds all have geometric limitations that restrict ultrasonic scanning from being fully performed from both sides of the welds. The NDE personnel, techniques and procedures used incorporate examination techniques qualified under Appendix VIII of the ASME Code, Section XI by the PDI for examination of the subject welds by single sided examination. Paragraph 50.55a(b)(2)(xv)(A)(2) states, in part, "Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld." The approved examination techniques have not been qualified in accordance with Appendix VIII to detect and size flaws on the opposite side of the austenitic welds. Consequently, any far-side detection of flaws is considered to be a "best effort."

As shown on the sketches and technical descriptions included in the licensee's submittals, welds BPY-C-1063-A, BPY-C-1065-A, BPY-C-3070-A, and BPY-C-3072-A, examinations have been completed to the extent practical with volumetric coverage of 50.0 percent (see Table 3) of the ASME Code-required volumes. The exam volume was limited to single-sided ultrasonic exams due to the presence of the austenitic weld materials and geometric configurations. The ultrasonic techniques employed for these welds have been qualified through the industry's PDI,

which meets ASME Code Section XI, Appendix VIII requirements. These techniques have been qualified only for flaws located on the near-side of the austenitic welds; far-side detection of flaws is considered to be a "best effort." For these reasons, the licensee has only taken credit for obtaining limited volumetric examination coverage.

The sketch and technical description for the coverage obtained for weld BPY-C-5019-A indicates that examination has been completed to the extent practical with volumetric coverage of 82.5 percent (see Table 3) of the ASME Code-required volumes. The exam volume was limited to single-sided ultrasonic exam due to the presence of the austenitic weld materials and geometric configuration. The ultrasonic techniques employed for this weld has been qualified through the industry's PDI, which meets ASME Code Section XI, Appendix VIII requirements. These techniques have been qualified only for flaws located on the near-side of the austenitic welds; far-side detection of flaws is considered to be a "best effort." For these reasons, the licensee has only taken credit for obtaining limited volumetric examination coverage of this weld. In addition to this exam, the NRC staff notes that the licensee was able to examine six other selected welds within the charging system susceptible to the same degradation mechanism, which had examinations with 100 percent coverage obtained.

The sketch and technical description for the coverage obtained for weld BSI-C-3004 indicates that examination has been completed to the extent practical with volumetric coverage of 90 percent (see Table 3) of the ASME Code-required volumes. The exam volume was limited to single-sided ultrasonic exam due to the presence of the austenitic weld materials and geometric configuration. The ultrasonic techniques employed for this weld has been qualified through the industry's PDI, which meets ASME Code Section XI, Appendix VIII requirements. These techniques have been qualified only for flaws located on the near-side of the austenitic welds; far-side detection of flaws is considered to be a "best effort." For these reasons, the licensee has only taken credit for obtaining limited volumetric examination coverage of this weld. In addition to this exam, the NRC staff notes that the licensee was able to examine four other selected welds within the safety injection system susceptible to the same degradation mechanism, which had examinations with 100 percent coverage obtained.

The licensee also performed liquid penetrant surface examinations and radiographic examinations on each pipe-to-valve weld (welds BPY-C-1063-A, BPY-C-1065-A, BPY-C-3070-A, and BPY-C-3072-A) with 100 percent coverage obtained. No indications were identified. The two remaining welds both have similar welds in their respective systems with the same degradation mechanism, all of which were 100 percent ultrasonically examined, with no non-acceptable indications detected.

Additionally, L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds; therefore, while the licensee has only taken credit for obtaining limited volumetric coverage, it is expected that the techniques employed would have provided coverage beyond the near-side of the welds.

The NRC staff has determined that there is no known operational experience showing cracking in similar stainless steel welds. The staff also notes that thermal fatigue is possible in stainless steel welds.

Given the location of these welds, it is expected that thermal fatigue cracking would progress relatively slowly though the weld. In addition, thermal fatigue cracking is fairly wide spread and is detectable by the examinations that the licensee performed. The licensee has implemented industry guidance (i.e., Material Reliability Program (MRP)-146 and recent Electric Power Research Institute (EPRI) MRP interim guidance) to better manage thermal fatigue cracking. The licensee states that none of these welds are within the area of concern for industry thermal fatigue guidelines MRP-146 or MRP-192. The NRC staff finds that any thermal fatigue-induced degradation that could affect the volumes covered would likely have been detected.

In this analysis, the NRC staff also found that, in addition to the required volumetric examinations for which relief is being requested, these welds are also required to receive a system leakage test according to the ASME Code, Section XI, IWB-2500 (Table IWB-2500-1, Examination Category B-P) during each refueling outage. Despite reduced coverage of the required examination volume, the staff finds that the licensee's supplemental examination techniques and inspections will provide additional assurance that any pattern of degradation, if it were to occur, would be detected, and the licensee will take appropriate correction actions.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject piping welds due to their configurations and materials. Although the ASME Code-required coverage could not be obtained, the ultrasonic techniques employed have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the weld materials on the opposite side of the welds. Based on the staff's consideration of (1) the aggregate coverage obtained for the subject welds, (2) the other similar welds with similar degradation modes that were successfully UT inspected at 100 percent coverage, (3) the extent of other methods of examinations, and (4) the licensee's performance of ultrasonic techniques employed to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected. Based on the above, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

## 4.0 CONCLUSION

Pursuant to 50.55a(g)(6)(i), the NRC staff has determined that it is impractical for the licensee to comply with the ASME Code, Section XI requirement; that the proposed examinations performed to the extent practical provides reasonable assurance of structural integrity and leak tightness of the subject welds; and that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Furthermore, based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present, evidence of it would have been detected by the examinations that were performed. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants relief for the subject examinations of the components contained in Relief Requests RR-04-17, RR-04-18, and RR-04-19 for the fourth 10-year ISI interval at MPS2.

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

Principal Contributors: Joel Jenkins
Donald Becker

Date: July 13, 2016

If you have any questions, please contact the project manager, Richard Guzman, at (301) 415-1030 or Richard.Guzman@nrc.gov.

Sincerely,

***/RA DPickett for/***

Travis L. Tate, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

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DBecker, NRR

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| OFFICE | DORL/LPL1-1/PM | DORL/LPL1-1/LA | DE/EVIB/BC |
|---|---|---|---|
| NAME | RGuzman | KGoldstein | JMcHale* |
| DATE | 6/20/16 | 6/21/16 | 3/7/16 |
| OFFICE | DE/EPNB/BC | DORL/LPL1-1-/BC | DORL/LPL1-1/PM |
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