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

April 26, 2011

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 203060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 3 – ISSUANCE OF RELIEF REQUESTS IR-2-51 THROUGH IR-2-60 REGARDING SECOND 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN (TAC. NOS. ME3809 THROUGH ME3818)

Dear Mr. Heacock:

By letter dated April 19, 2010, as supplemented by letter dated January 20, 2011 (Agencywide Documents Access and Management System Accession Nos. ML101130187 and ML110250259, respectively), Dominion Nuclear Connecticut, Inc. (DNC or the licensee) submitted relief requests (RRs) IR-2-51, IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-58, IR-2-59, and IR-2-60 for Millstone Power Station, Unit No 3 (MPS3). DNC requested relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI for the second 10-year inservice inspection (ISI) interval, in which the licensee adopted the 1989 Edition with no Addenda. The second 10-year ISI interval began on April 23, 1999, and ended April 22, 2009. Each relief request contained in the April 19, 2010, submittal is addressed separately.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from inservice inspection items listed in RRs IR-2-51, IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, and IR-2-59 on the basis that the code requirements are impractical. Pursuant to 10 CFR 50.55a(g)(6)(i), the licensee requested to use alternative requirements, for ISI items listed in RR IR-2-60 on the basis that the code requirements are impractical.

The NRC staff has reviewed the licensee's submittals and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in RRs IR-2-51 (in part)[1], IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-59, and IR-2-60. The NRC staff has concluded that based on the volumetric, surface and/or visual examination coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff concludes that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components.

Therefore, the NRC staff grants relief for the subject examinations of the components contained in RRs IR-2-51 (in part)[1], IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-59, and IR-2-60. The NRC staff has further determined that granting these RRs 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,

[1] As outlined in the attached safety evaluation for 2 of the 4 items in RR IR-2-51, the licensee requested relief from the ASME Code, Section XI, Item B1.21 and B1.22 requirements. ASME Code, Section XI, Items B1.21 and B1.22 require the accessible length of the subject welds to be examined. The licensee stated in its request that the accessible length of the subject welds were examined. Therefore, the licensee met the ASME Code requirements for these welds and does not need relief from the ASME Code requirements.

and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

For RR IR-2-58 the licensee, pursuant to 10 CFR 50.55a(a)(3)(ii), requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty.

For IR-2-58 the NRC staff concludes that performing the VT-3 examination of the reactor pressure vessel (RPV) supports in accordance with the ASME Code, Section XI would require excessive personnel radiation exposure and poses a hardship for the licensee without a compensating increase in the level of quality and safety. Further, the NRC staff concludes that the licensee's alternative of performing a limited visual VT-3 examination on the exposed portions of the supports and the surrounding insulation provides reasonable assurance of structural integrity of the subject components. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC authorizes the use of limited visual VT-3 examination as an alternative to the ASME Code, Section XI, required VT-3 examination of the RPV supports for the second ISI interval at MPS3.

If you have any question, please contact the Project Manager, John Hughey, at 301-415-3204.

Sincerely,

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

Docket No. 50-423

Enclosure:
As stated

cc w/encl: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SECOND 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF NOS. IR-2-51, IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57,

IR-2-58, IR-2-59, and IR-2-60

MILLSTONE POWER STATION, UNIT NO. 3

DOMINON NUCLEAR CONNECTICUT, INC.

DOCKET NUMBER 50-423

1.0 INTRODUCTION

By letter dated April 19, 2010, as supplemented by letter dated January 20, 2011 (Agencywide Documents Access and Management System Accession Nos. ML101130187 and ML110250259, respectively), Dominion Nuclear Connecticut, Inc. (DNC or the licensee) submitted relief requests (RRs) IR-2-51, IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-58, IR-2-59, and IR-2-60 for Millstone Power Station, Unit No 3 (MPS3). DNC requested relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI for the second 10-year inservice inspection (ISI) interval, in which the licensee adopted the 1989 Edition with no Addenda. The second 10-year ISI interval began on April 23, 1999, and ended April 22, 2009. Each relief request contained in the April 19, 2010, submittal is addressed separately.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from ISI items listed in RRs IR-2-51, IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, and IR-2-59 on the basis that the code requirements, are impractical. Pursuant to 10 CFR 50.55a(g)(6)(i), the licensee requested to use alternative requirements, for ISI items listed in RR IR-2-60 on the basis that the code requirements are impractical.

For RR IR-2-58 the licensee, pursuant to 10 CFR 50.55a(a)(3)(ii), requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty.

2.0 REGULATORY REQUIREMENTS

The ISI of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g), except where specific relief has been granted by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives

would provide an acceptable level of quality and safety; or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for MPS3 second 10-year interval inservice inspection program, which ended on April 22, 2009, is the 1989 Edition, with no Addenda.

3.0 EVALUATION

The information provided by the licensee in support of the requests for relief from ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the licensee's requests have been evaluated according to ASME Code Examination Category and corresponding request for relief.

3.1 Request for Relief IR-2-51, ASME Code, Section XI, Examination Category B-A, Items B1.11, B1.12, B1.21, and B1.22, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Items B1.11 and B1.12 require essentially 100% volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-1 and -2, respectively, of the length of reactor pressure vessel (RPV) circumferential and longitudinal shell welds. ASME Code, Section XI, Items B1.21 and B1.22 require essentially 100% volumetric examination, as defined by Figure IWB-2500-3, of the "accessible length" of circumferential and meridional head welds on the RPV. "Essentially 100%", as clarified by ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, is greater than 90% 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 1.147, Revision 16, *Inservice Inspection Code Case Acceptability* (RG 1.147, Revision 16).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of ASME Code, Class 1 RPV circumferential and longitudinal shell welds, and circumferential and meridional head welds listed in Table 3.1.1 below. (Provided by the licensee).

Table 3.1.1 – ASME Code, Section XI, Examination Category B-A			
ASME Code Item	**Weld ID**	**Weld Type**	**Coverage Obtained**
B1.11	101-141	Lower Shell-to-Bottom Head Torus	54.0%
B1.12	101-122A	Upper Shell Longitudinal Seam @ 90 Azimuth	74.0%
B1.12	101-122B	Upper Shell Longitudinal Seam @ 210 Azimuth	87.0%
B1.12	101-122C	Upper Shell Longitudinal Seam @ 330 Azimuth	87.0%
B1.21	102-151	Torus-to-Dollar Plate Welds	38.0%
B1.22	101-154A	Torus Peel Segment @ 0 Azimuth	70.0%
B1.22	101-154B	Torus Peel Segment @ 90 Azimuth	84.0%
B1.22	101-154C	Torus Peel Segment @ 180 Azimuth	84.0%

Licensee's Basis for Relief Request

As stated by the licensee:

> A total of 58 permanent incore instrument nozzles penetrate the bottom head and six core support lugs permanently attached to the vessel interior limit the access to the lower head welds. The close proximity of the inlet nozzle and outlet nozzle boss limits the ultrasonic [UT] scanning of the upper shell longitudinal seam welds. These noted obstructions prevent achieving the essentially 100 percent volume examination coverage required by [the ASME Code.]
>
> To increase examination coverage on the subject welds requires a significant design modification or replacement of components with a different design to eliminate the noted obstructions. This is impractical due to the cost, additional radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of pressure retaining welds in the RPV. However, the design configuration of the RPV circumferential and longitudinal shell welds, and circumferential and meridional head welds, limit complete examinations due to adjacent components. In order to effectively increase the examination coverage, the RPV and adjacent components would require design modifications or replacement. This would place a burden on the licensee; therefore, examining essentially 100 percent of the ASME Code-required volumes is considered impractical.

The design of the MPS3 RPV limits the examination of the subject welds as shown in technical descriptions and sketches provided by the licensee. The subject RPV welds listed in Table 3.1.1 above were examined using 45-degree shear and 45- and 70-degree refracted longitudinal wave scans with equipment, procedures and personnel that were qualified by performance demonstration according to ASME Code, Section XI, Appendix VIII. Examinations of the subject welds were performed with automatic UT inspection equipment from the inside of the RPV. The licensee stated that consideration was given to augmenting the examinations from the outside surface, but doing so would cause a significant increase in radiation exposure without a compensating increase in the level of quality or safety.

For Lower Shell-to-Bottom Head Torus Circumferential Weld 101-141, the UT examination was restricted from accessing the entire scan region under the six core support lugs and partially limited between the core support lugs. The licensee was able to obtain approximately 54.0% of the required ASME Code volumetric coverage for this circumferential weld. On the Upper Shell Longitudinal Seam Welds 101-122A through C, scan restrictions caused by the inlet and outlet RPV nozzle boss allowed between 74.0 percent and 87.0 percent of the required ASME Code volume to be completed as shown in Table 3.1.1 above. Two subsurface indications were detected on Lower Shell-to-Bottom Head Torus Circumferential Weld 101-141 and Upper Shell Longitudinal Seam Weld 101-122A, and were both evaluated as being acceptable in accordance with the criteria of IWB-3510-1 of ASME Code, Section XI.

For Lower Shell-to-Bottom Head Torus Weld 101-141 and Upper Shell Longitudinal Seam Welds 101-122 A, B, and C, the licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage due to their design geometries and proximity of integral RPV appurtenances. Based on the volumetric coverage obtained, along with the full examination of other RPV pressure retaining welds, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

ASME Code, Section XI, Items B1.21 and B1.22 requires that Torus-to-Dollar Plate Circumferential Weld 102-151 and Torus Peel Segment Welds 101-154 A, B, and C be subject to essentially 100 percent volumetric examination of the "accessible length" of

the welds. The ASME Code Committees recognize the limitations of examining these welds and specifically stated in this particular ASME Code requirement to examine the "accessible length" of the welds. The licensee stated in its relief that it did examine the "accessible length" of the subject welds. Therefore, the licensee met the ASME Code requirements for these welds and does not need relief from the ASME Code requirements.

3.2 Request for Relief IR-2-52, ASME Code, Section XI, Examination Category B-B, Items B2.11 and B2.40, Pressure Retaining Welds in Vessels Other than Reactor Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-B, Items B2.11 and B2.40 require essentially 100% volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-1 and IWB-2500-6, of pressurizer (PZR) circumferential shell-to-head welds and steam generator (SG) tubesheet-to-head welds, respectively. "Essentially 100 percent," as clarified by ASME Code Case N-460, 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 RG 1.147, Revision 16.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination for PZR Shell-to-Head Weld 03-007-SW-J and SG Tubesheet-to-Head Weld 03-003-SW-Z.

Licensee's Basis for Relief Request

As stated by the licensee:

> **PZR Shell-to-Head Weld (03-007-SW-J)**
>
> The [PZR Shell-to-Head Weld] (03-007-SW-J) examination is limited due to seven permanently welded 2" x 2" insulation support ring mounting pads, four 3" diameter instrument taps and four vertical support members from a [PZR] safety valve restraint that obstruct portions of the subject weld and preclude achieving the required 100 percent volume examination coverage. To increase the examination coverage for [PZR Shell-to-Head Weld Number 03-007-SW-J] requires removal of the permanently welded insulation support ring mounting pads by cutting the mounting pad welds and then reinstalling the mounting pads by welding following completion of the examination. Additionally, removal of the [PZR] safety valve restraint would be required which also requires removal of the safety valves and associated piping to provide clearance necessary for the restraint to be removed. To attempt removal of the massive restraint could also subject adjacent plant equipment to potential damage during the removal process.

SG Tubesheet-to-Head Weld (03-003-SW-Z)

The [SG Tubesheet-to-Head Weld (03-003-SW-Z)] examination is limited due to the close proximity of the tubesheet flange that limits scanning on the tubesheet side of the weld. Additional limitations are due to 4 lower [SG] support vertical members that obstruct portions of the subject weld and preclude achieving the required 100 percent volume examination coverage. To increase the examination coverage for [SG Tubesheet-to-Head Weld 03-003-SW-Z] requires removal of the lower [SG] support members which provide stability and support the weight of the [SG.] Additionally, a significant design modification or replacement of the component with a different design is required to eliminate the obstructions caused by the location of the tubesheet.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of PZR shell-to-head circumferential welds and SG tubesheet-to-head welds. However, for the subject welds at MPS3, complete examinations are restricted by the geometric configuration of the welds and scan limitations caused by adjacent appurtenances. In order to effectively increase the examination coverage, the PZR, SG, and appurtenances would require design modifications or replacement. This would place a burden on the licensee; thus, examining 100 percent of the ASME Code-required volume is considered impractical.

As shown in the sketches and technical descriptions included in the licensee's submittals, examination of the PZR Shell-to-Head Weld 03-007-SW-J has been performed to the extent practical, with the licensee obtaining coverage of 74.7 percent of the ASME Code-required inspection volume. The permanent insulation support ring mounting pads, instrumentation taps, and PZR safety valve vertical support members limited the ASME Code-required volumetric examination for the SA533, carbon steel PZR circumferential weld. On the SA508 carbon steel SG Tubesheet-to-Head Weld 03-003-SW-Z, examination limitations were caused by the proximity of the tubesheet flange and SG lower vertical support members, which allowed 81.5 percent of the ASME Code-required volume to be completed. The PZR and SG welds were examined with manual UT techniques using 0-degree longitudinal and 45- and 60-degree shear waves in accordance with applicable requirements of the ASME Code, Section V, Article 4. No unacceptable indications were observed in these welds.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject welds due to the design configurations of the PZR and SG, and their adjacent components. Based on the volumetric coverage obtained, along with the examinations completed on other pressure retaining welds in ASME Code, Section XI, Examination Category B-B, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

3.3 Request for Relief IR-2-53, ASME Code, Section XI, Examination Category B-D, Items B3.90, B3.110, and B3.130, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Items B3.90, B3.110 and B3.130 require 100 percent volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-7 (a) through (d), as applicable, of full penetration ASME Code, Class 1 nozzle-to-vessel welds on the RPV, PZR, and SG, respectively. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examinations for the ASME Code, Class 1 nozzle-to-vessel welds listed below in Table 3.3.1.

Table 3.3.1 – ASME Code, Section XI, Examination Category B-D

ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B3.90	107-1221A	RPV Outlet Nozzle-to-Shell Weld	70.0%
B3.90	107-1221B	RPV Outlet Nozzle-to-Shell Weld	70.0%
B3.90	107-1221C	RPV Outlet Nozzle-to-Shell Weld	70.0%
B3.90	107-1221D	RPV Outlet Nozzle-to-Shell Weld	70.0%
B3.110	03-007-SW-A	PZR Safety Nozzle-to-Head Weld	77.7%
B3.110	03-007-SW-B	PZR Safety Nozzle-to-Head Weld	77.7%
B3.110	03-007-SW-C	PZR Safety Nozzle-to-Head Weld	77.7%
B3.110	03-007-SW-D	PZR Relief Nozzle-to-Head Weld	77.7%
B3.110	03-007-SW-E	PZR Spray Nozzle-to-Head Weld	77.7%

Table 3.3.1 – ASME Code, Section XI, Examination Category B-D			
ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B3.110	03-007-SW-S	PZR Surge Nozzle-to-Head Weld	64.2%
B3.130	03-006-SW-U	SG Outlet Nozzle-to-Head Weld	77.8%
B3.130	03-006-SW-V	SG Inlet Nozzle-to-Head Weld	77.8%

Licensee's Basis for Relief Request

As stated by the licensee:

> The reactor vessel nozzle to head welds were examined using automated [UT] technique during the 10-year reactor vessel examination. Due to the permanent obstruction of the outlet nozzle boss, scanning was limited on the shell side of the welds which prevent attaining 100 percent examination coverage.
>
> The [PZR] surge nozzle-to-head weld was examined with a manual [UT] technique using the best available technology available to achieve the maximum examination practicable. There are 78 [PZR] heaters that penetrate the [PZR] bottom head. Due to permanent obstructions caused by these [PZR] heater penetrations, scanning was limited on the head side of the weld which prevents attaining 100 percent examination coverage.
>
> The steam generator nozzle-to-head welds, and the pressurizer spray, safety, and relief nozzle-to-head welds were examined with a manual [UT] technique. Due to the nozzle configuration with its outside diameter taper, scanning on the nozzle side of the weld is limited to circumferential scans only and prevents attaining 100 percent examination coverage.
>
> To increase examination coverage on the subject welds requires a significant design modification or replacement of components with a different design to eliminate the noted obstructions, which is considered impractical due to the cost, additional radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric examination of ASME Code, Class 1

nozzle-to-vessel welds. However, the design configurations of the subject welds and the proximity of surrounding appurtenances limit access for UT scanning. In order to effectively increase the examination coverage, the nozzle-to-vessel welds would require design modifications and removal of adjacent components. This would place a burden on the licensee; thus, 100 percent ASME Code-required volumetric examinations are considered impractical.

The RPV, PZR, and SG nozzle-to-vessel welds shown in Table 3.3.1 above are constructed of carbon steel material with stainless steel inside diameter cladding. The welds on the subject nozzles extend the full thickness of the vessel shell/head. These nozzles are of the "set-in" design which essentially makes the welds concentric rings aligned parallel with the nozzle axes in the through-wall direction of the vessel. This nozzle design geometry limits ASME Code-required UT angle beam examinations to be performed primarily from the vessel side of the welds. Other interferences that caused scanning limitations were nozzle bosses and PZR heaters.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject RPV, PZR, and SG nozzle-to-vessel welds have been completed to the extent practical with volumetric coverage ranging from approximately 64.2 percent to 77.8 percent (see Table 3.3.1 above) of the ASME Code-required volumes. The examination volumes typically included the weld and base materials near the inside surface of the weld joint, which are the highest regions of stress, and where one would expect degradation sources to be manifested should they occur. The RPV nozzle-to-vessel weld examinations were conducted with equipment, procedures and personnel that were qualified to the process outlined in ASME Code, Section XI, Appendix VIII as conditioned by 10 CFR 50.55a(b)(2) using 45-degree shear and 15-, 45-, and 70-degree refracted longitudinal wave examinations. The PZR and SG nozzle-to-vessel weld examinations were performed with manual UT techniques in accordance with the applicable requirements of the ASME Code Section V, Article 4. The PZR and SG welds were examined using 0-degree longitudinal and 45- and 60-degree shear waves. There were three subsurface indications detected on the RPV nozzles that were evaluated to be acceptable according to ASME Code, Section XI, IWB-3512-1.

Although UT scans were primarily limited to the vessel side, recent studies have found that inspections conducted through carbon steel are equally effective whether the UT waves have only to propagate through the base metal, or have to also propagate through the carbon steel weldment.[1] Therefore, it is expected that the UT techniques employed by the licensee would detect structurally significant flaws that might occur on either side of the subject welds due to the fine-grained carbon steel microstructures.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject nozzle-to-vessel welds due to their design and adjacent component obstructions. Based on the volumetric coverage

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[1] P. G. Heasler, and S. R. Doctor, 1996. *Piping Inspection Round Robin*, NUREG/CR-5068, PNNL-10475, U. S. Nuclear Regulatory Commission, Washington, DC.

obtained for the subject welds, and considering the licensee's performance of UT techniques employed to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

3.4 Request for Relief IR-2-54, ASME Code, Section XI, Examination Category B-H, Item B8.20, Integral Attachments for Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-H, Item B8.20 requires essentially 100 percent volumetric or surface examination, as applicable, as defined by ASME Code, Section XI, Figures IWB-2500-13, -14, and -15 for PZR integrally welded attachments. "Essentially 100 percent", as clarified by ASME Code Case N-460, 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 RG 1.147, Revision 16.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required surface examination of MPS3, Class 1 PZR attachment welds shown in Table 3.4.1 below.

Table 3.4.1 – ASME Code, Section XI, Examination Category B-H

ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B8.20	03-007-SW-TL	PZR North Support Bracket (Left)	20.0%
B8.20	03-007-SW-TR	PZR North Support Bracket (Right)	20.0%
B8.20	03-007-SW-VL	PZR South Support Bracket (Left)	20.0%
B8.20	03-007-SW-VR	PZR South Support Bracket (Right)	20.0%
B8.20	03-007-SW-WL	PZR East Support Bracket (Left)	20.0%
B8.20	03-007-SW-WR	PZR East Support Bracket (Right)	20.0%
B8.20	03-007-SW-XL	PZR West Support Bracket (Left)	20.0%
B8.20	03-007-SW-XR	PZR West Support Bracket (Right)	20.0%

Licensee's Basis for Relief Request

As stated by the licensee:

> The subject attachment welds and their associated lugs provide attachment points for the [PZR] safety valve and piping restraint. There

are 8 welded lugs consisting of 4 pairs with each pair located approximately every 90 degrees around the circumference of the [PZR]. With the [PZR] safety valve restraint in place, the support brackets mount over the positioning lugs and are pinned in place. These support brackets overlap approximately 80 percent of each attachment lug and their associated welds leaving this portion of each weld inaccessible for examination. To increase examination coverage on the subject welds requires removal of a massive component restraint, which would also require removal of [PZR] safety valves and associated piping. Removal of the restraint is considered impractical due to the increased radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee considered both UT and liquid penetrant (PT) examinations as alternatives for additional coverage; however, it was determined that no additional coverage could be attained using these methods. The licensee examined the subject PZR support bracket lugs to the extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent surface examination of ASME Code, Class 1 PZR integral attachment welds. However, surface examinations are limited due to partial inaccessibility caused by their design and encapsulating restraints. In order for the licensee to obtain 100 percent of the ASME Code-required examination coverage, the integral attachment welds would have to be redesigned and modified. This would place a burden on the licensee; therefore, the ASME Code examination requirements are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, the magnetic particle (MT) surface examinations for the eight carbon steel PZR support bracket lugs listed in Table 3.4.1 above are limited due to access restrictions caused by safety valve restraint brackets that are mounted over the support lugs and encapsulate 80 percent of the surface. The support brackets are pinned in place and would require disassembly to increase the examination coverage. These supports weigh approximately 10,000 pounds which require specialized equipment for removal and reinstallation. Critical alignments are a concern upon reinstallation. Also, the configuration of these supports would require removal of the PZR safety valve and associated piping. The examinations have been performed to the extent practical, with the licensee obtaining approximately 20 percent of the ASME Code-required surface coverage. Only one laminar indication was detected on Support Bracket Lug 03-007-SW-WR and it was found to be acceptable per ASME Code, Section XI, IWB-3516.2. As noted above, both UT and PT examinations were considered by the licensee as alternatives for additional coverage; however, it was determined that no additional coverage could be attained using these methods.

The licensee has shown that it is impractical to meet the ASME Code-required surface examination coverage for the subject ASME Code, Class 1 PZR integral attachment

welds. However, based on the surface coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

3.5 Request for Relief IR-2-55, ASME Code, Section XI, Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category C-A, Item C1.20, requires essentially 100 percent volumetric examination, as defined by Figure IWC-2500-1, of the length of Class 2 circumferential vessel head welds. "Essentially 100 percent", as clarified by ASME Code Case N-460, 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 RG 1.147, Revision 16.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of the "A" Residual Heat Removal (RHR) Heat Exchanger Lower Head-to-Shell Weld 03-073-008.

Licensee's Basis for Relief Request

As stated by the licensee:

> Due to the original design of the heat exchanger, the position of the inlet and outlet nozzle-to-shell reinforcing plates are in close proximity to the subject head-to-flange weld limiting the [UT] examination coverage from the shell side of the weld.
>
> To increase examination coverage on the subject welds requires removal of the permanently welded reinforcing plates that are part of the original heat exchanger design or replacement of the heat exchanger with a design that would allow for complete examination coverage of the subject weld. This option to meet the 100 percent [of the ASME Code] examination requirement is considered impractical due to the cost, increased radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of circumferential head welds on selected ASME Code, Class 2 pressure vessels. However, for the subject weld on the MPS3 RHR heat exchanger, complete examinations are limited due to the design configuration of these components. In order to achieve greater volumetric coverage, the RHR heat exchanger or adjacent components would have to be redesigned and modified. This would place a burden on the licensee, therefore the ASME Code examinations are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the "A" RHR Heat Exchanger Lower Head-to-Shell Weld 03-073-008 have been performed to the extent practical, with the licensee obtaining approximately 79.7 percent of the required ASME Code examination volume. The examinations are limited due to the welded nozzle reinforcing plates which limits access on the shell side of the welds. The RHR heat exchanger is fabricated of Type 304 stainless steel. The licensee examined these welds completely from the head side using 45-degree shear waves to achieve full circumferential and axial coverage along the weld length. The licensee performed an additional 70-degree refracted longitudinal wave (L-wave) scan from the head to maximize coverage. L-wave techniques have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds.[2,3] While the licensee has only taken credit for obtaining volumetric coverage from primarily one side of the subject weld, the techniques employed would have provided coverage beyond the near-side of the weld. Limited scanning was performed on the shell side with a 45-degree shear wave due to proximity of the nozzle reinforcement plates on the RHR heat exchanger. No recordable flaw indications were observed.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject weld due to the design geometry of the weld and proximity of integral appurtenances. However, based on the volumetric coverage obtained, and the ultrasonic techniques employed, it is reasonable to conclude that, if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected by the examinations performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

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2 F.V. Ammirato, X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

3 P. Lemaitre, T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

3.6 Request for Relief IR-2-56, ASME Code, Section XI, Examination Category C-C, Item C3.20, Integral Attachments for Vessels, Piping, Pumps, and Valves

ASME Code Requirement

ASME Code, Section XI, Examination Category C-C, Item C3.20 requires 100 percent surface examination, as defined by ASME Code, Section XI, Figure IWC-2500-5, of integrally welded attachments to ASME Code, Class 2 piping. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100 percent surface examinations for the set of eight RHR system piping lug attachment welds on support RHS-4-PSR052.

Licensee's Basis for Relief Request

As stated by the licensee:

> The surface examination of the subject welds were performed to the maximum extent practicable with the limitations caused by obstruction of the permanently welded support members and the physical location of the pipe in close proximity to a permanent building wall structure.
>
> To increase the examination coverage on the subject welds requires removal of the permanent support members by physically cutting the support members apart and replacing the support members by rewelding following the completion of the surface examination. Removal of the permanently welded support members is considered to be impractical based on the increased radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

Staff Evaluation

The ASME Code requires 100 percent surface examination of the subject ASME Code, Class 2 integral attachment piping welds. However, surface examinations are limited due to inaccessibility and interferences caused by permanent support members and a building wall. In order for the licensee to obtain 100 percent of the ASME Code-required examination coverage, the integral attachment welds would have to be redesigned and

modified. This would place a burden on the licensee; therefore, the ASME Code examination requirements are considered impractical.

As shown on the sketch and technical descriptions included in the licensee's submittals, dye penetrant examinations of eight stainless steel RHR piping lug attachment welds for Support RHS-4-PSR052 have been performed to the extent practical, with the licensee obtaining a combined surface examination coverage of approximately 33.3 percent of the ASME Code requirements. There are three segments of the weld to be examined on all eight welded lugs. Four of the piping lugs and their three weld segments are completely inaccessible due to permanent support members on the top and bottom of the pipe and the proximity to a building wall. The other four piping lugs are only limited on one of the three weld segments due to the permanent support member located on the top and bottom of these welds. Therefore, the separate coverage for four of the lugs was 0 percent and the other four was 66 percent for a combined total coverage for all eight welds of 33.3 percent as stated above. No reportable indications were detected during these surface examinations.

The licensee has shown that it is impractical to meet the ASME Code-required surface examination coverage for the subject ASME Code, Class 2 integral attachment piping welds. However, based on the surface coverage obtained, it is reasonable to conclude, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

3.7 Request for Relief IR-2-57, ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping

ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, require 100 percent surface and volumetric examination, as defined by ASME Code, Section XI, Figure IWC-2500-7, of selected ASME Code, Class 2 austenitic stainless steel or high alloy circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100 percent volumetric examination of the ASME Code, Class 2 austenitic stainless steel or high alloy piping welds shown in Table 3.7.1 below.

Table 3.7.1 – ASME Code, Section XI, Examination Category C-F-1			
ASME Code Item	**Weld ID**	**Weld Configuration**	**Coverage Obtained**
C5.11	CHS-30-11-SW-E	6" Pipe-to-Flange	50.0%
C5.11	CHS-30-12-SW-B	6" Pipe-to-Flange	49.5%
C5.11	CHS-30-12-SW-C	6" Flange-to-Pipe	50.0%
C5.11	CHS-30-13-SW-B	6" Flange-to-Elbow	50.0%
C5.11	QSS-3-4-SW-K	12" Pipe-to-Flange	50.0%
C5.11	QSS-3-FW-5BR	12" Flange-to-Pipe	44.0%
C5.11	QSS-6-3-SW-D	14" Pipe-to-Flange	50.0%
C5.11	QSS-6-3-SW-B	14" Flange-to-Elbow	50.0%
C5.11	QSS-6-4-SW-D	14" Pipe-to-Flange	48.5%
C5.11	RHS-501-FW-6	12" Valve-to-Pipe	50.0%
C5.11	RHS-502-FW-7	12" Valve-to-Pipe	50.0%
C5.11	RHS-6-2-SW-K	14" Pipe-to-Flange	50.0%
C5.11	RHS-6-FW-4	14" Pipe-to-Pump Nozzle	50.0%
C5.11	RSS-11-2-SW-B	16" Flange-to-Elbow	50.0%
C5.11	RSS-1-3-SW-B	12" Flange-to-Pipe	49.5%
C5.11	RSS-15-3-SW-B	12" Valve-to-Pipe	50.0%
C5.11	RSS-16-2-SW-B	12" Valve-to-Pipe	50.0%
C5.11	RSS-19-4-SW-G	16" Reducer-to-Nozzle	48.5%
C5.11	RSS-21-4-SW-G	16" Reducer-to-Flange	49.0%
C5.11	RSS-8-2-SW-R	16" Flange-to-Elbow	50.0%
C5.11	SIH-12-3-SW-C	6" Pipe-to-Flange	49.5%
C5.11	SIH-12-FW-3	6" Pipe-to-Valve	50.0%
C5.11	SIL-11-FW-3	8" Valve-to-Pipe	50.0%
C5.11	SIL-152A-FW-1	24" Flange-to-Pipe	50.0%
C5.11	SIL-25-FW-1-5M	8" Pipe-to-Tee	75.0%
C5.11	SIL-25-FW-1-8M	8" Pipe-to-Tee	75.0%
C5.11	SIL-25-FW-2	8" Valve-to-Pipe	45.0%
C5.11	SIL-25-FW-3	8" Valve-to-Pipe	50.0%
C5.11	SIL-40-FW-1	6" Valve-to-Pipe	50.0%
C5.11	SIL-9-FW-1	6" Pipe-to-Valve	50.0%
C5.21	CHS-507-10-SW-11	4" Elbow-to-Tee	72.5%
C5.21	CHS-507-FW-19	4" Pipe-to-Valve	46.0%
C5.21	SIH-4-3-SW-B	4" Flange-to-Pipe	41.0%

Licensee's Basis for Relief Request

As stated by the licensee:

> Based on the configuration limited to single side access, relief is requested for complying with the essentially 100 percent required examination coverage for [the subject] piping welds. The subject piping welds are located Within the Chemical and Volume Control (CHS), Quench Spray (QSS), Residual Heat Removal (RHS), Containment Recirculation Spray (RSS), High Pressure Safety Injection (SIH) and Low Pressure Safety Injection (SIL) systems. Note that examination coverage listed is that attained during examination with no credit taken for the far side of each weld in which examination from that side could not be performed.
>
> Compliance with code requirements requires extensive modification or replacement of components with a design that allows examination from both sides of the weld. This option to meet the required 100 percent volume examination coverage is considered impractical based on the cost, additional radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination for selected ASME Code, Class 2 pressure retaining welds in austenitic stainless steel or high alloy circumferential piping. The volumetric examination must be applied from both sides of the weld to maximize coverage. However, volumetric examinations are limited by the geometry of the welds and the associated piping configurations, which restrict scanning to one side only. To gain access for examination, the welds and piping would require design modifications. Imposition of this requirement would create a burden on the licensee, therefore, the ASME Code-required 100 percent volumetric examinations from both sides of the welds are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, access for examination of the subject welds is limited primarily to the pipe, elbow, or reducer side of the welds due to austenitic stainless steel materials, weld-o-lets, and tapers from the valve-to-pipe, pipe-to-tee, pipe-to-flange, flange-to-elbow, elbow-to-tee, pipe-to-nozzle, reducer-to-nozzle, and reducer-to-flange weld configurations (see Table 3.7.1 above). The UT techniques employed for these welds have been qualified through the industry's Performance Demonstration Initiative (PDI), which meets ASME Code, Section XI, Appendix VIII requirements as conditioned by 10 CFR 50.55a(b)(2). These techniques have been qualified for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." For

this reason, the licensee has taken credit for completing only 50% of the ASME Code-required inspection volume on many of the subject piping welds. The licensee completed the ASME Code surface examinations to their full extent as required (the licensee invoked ASME Code Case N-663 *"Alternative Requirements for Class 1 and 2 Surface Examinations Section XI, Division 1,"* mid-interval. ASME Code Case N-663 was approved for general use in RG 1.147, Revision 16). No unacceptable indications were noted during the performance of the volumetric or surface examinations.

The licensee's UT techniques included 45-, 60- and 70-degree shear waves and 60- and 70-degree refracted longitudinal waves (L-waves), as applicable, on many of the subject welds. L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds.[4, 5] While the licensee has only taken credit for obtaining 50% volumetric coverage, the techniques employed would have provided coverage beyond the near-side of the welds. A review of the weld cross-sectional information indicates that limited volumetric coverage on the far-side of the welds has been obtained by the licensee.

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 design and ultrasonic access restrictions. Although the ASME Code-required coverage could not be obtained, the UT techniques employed would have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the weld fusion zone and base materials on the opposite side of the welds. Based on the aggregate coverage obtained for the subject welds, and considering the licensee's performance of UT techniques used to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

3.8 Request for Relief IR-2-58, ASME Code, Section XI, Examination Category F-A, Item F1.40, Supports

ASME Code Requirement

ASME Code, Section XI, Examination Category F-A, Item F1.40 requires 100 percent visual VT-3 examination, as defined by ASME Code, Section XI, Figure IWF-1300-1, of selected ASME Code, Class 1, 2, 3, and MC supports other than piping supports.

Note: In evaluating the licensee's original submittal and response to the NRC staff's questions, the NRC staff determined that the request did not meet the impractical criteria pursuant to 10 CFR 50.55a(g)(5)(iii); therefore, the licensee's submittal has been evaluated pursuant to 10 CFR 50.55a(a)(3)(ii), in that compliance with the specified

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4 F. V. Ammirato, X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

5 P. Lemaitre, T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Licensee's ASME Code Relief Request

The licensee requested relief from the ASME Code-required 100% visual examination of RPV supports, 3-RVS-1, 3-RVS-2, 3-RVS-3, and 3-RVS-4.

Licensee's Basis for Relief Request

As stated by the licensee:

> The majority of each support is encased in permanent insulation panels of the reactor vessel and the reactor vessel nozzles. Only a portion (approximately 10 percent) of the end of each support is accessible for VT-3 visual examination. The supports are located in a congested, confined space below the permanent refueling cavity seal ring. The area can only be accessed by entry through a seal ring manway. In addition to the difficult access, the radiation levels are approximately 50 [millirem] per hour. It is estimated that the removal and reinstallation of the permanent insulation panels in this confined space would result in additional exposure of approximately 2 man-rem.
>
> To increase the direct visual examination coverage of the subject supports requires removal of the reactor vessel insulation panels. Removal of the reactor vessel insulation panels to meet the 100 percent [ASME Code] examination requirement [would be a hardship] due to the access restrictions, high radiation levels and support design.

Note: In the licensee's letter dated January 20, 2011, the exposure rate expected during the removal and reinstallation of the permanent insulation panels in this confined space to examine the subject supports, was increased to 26.08 man-rem.

Licensee's Proposed Alternative Examination

As stated by the licensee:

> The subject supports received a VT-3 visual examination on the accessible portions to the maximum extent practical with the insulation in place. In addition, the insulation was examined for any evidence of disturbance or degradation which may be attributed to abnormal support disturbance.

NRC Staff Evaluation

The ASME Code requires 100 percent visual examination of ASME Code, Class 1 RPV nozzle supports. However, visual examinations of these supports at MPS3 are limited due to partial inaccessibility caused by their design and the surrounding environment. In

order for the licensee to obtain 100 percent of the ASME Code-required examination coverage, RPV insulation panels need to be removed which would cause excessive radiation exposure to personnel. This would place a significant hardship on the licensee without a compensating increase in the level of quality and safety.

The nozzle supports consist of a nozzle pad and steel plates positioned between a steel support structure and the RPV hot and cold leg nozzles, and encased by eight permanent RPV insulation panels. The insulation panels range from approximately 230 to 1200 pounds, which requires special rigging to be setup in a very congested area. This effort represents a significant amount of total man-hours and radiation exposure. The licensee calculated that 26.08 man-rem would be necessary for this effort.

Visual VT-3, examinations on RPV nozzle supports 3-RVS-1 through -4, have been performed to the extent practical, with the licensee obtaining approximately 10.0% of the ASME Code-required visual coverage. The licensee also examined the surrounding insulation for any evidence of deformation or degradation attributable to abnormal support disturbance. These nozzle supports are exposed to high thermal loads during normal operations, and physical displacement of the insulation should be evident if the supports experience significant degradation. Therefore, removal of the insulation to increase visual VT-3 coverage on the supports would not provide a compensating increase in quality or safety.

Based on the above evaluation, the NRC staff has determined that the ASME Code-required 100 percent visual VT-3 examination coverage for the subject RPV supports represents a hardship without a compensating increase in the level of quality and safety. Based on the visual coverage obtained on the accessible supports and surrounding insulation, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would be have been detected by the examinations that were performed.

3.9 Request for Relief IR-2-59, ASME Code, Section XI, Examination Category R-A, Items R1.11 and R1.20, Risk Informed Piping Examinations

ASME Code Requirement

The examination requirements for the subject piping welds at MPS3 are governed by a Risk-Informed Inservice Inspection (RI-ISI) program that was approved by the NRC in a Safety Evaluation (SE) dated March 12, 2002 (ADAMS Accession No. ML020570312). The RI-ISI program was developed in accordance with the Westinghouse Owners Group Topical Report WCAP-14572, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report, Revision 1-NP-A" (ADAMS Accession No. ML042390336) As part of the NRC-approved program, the licensee has implemented inspection requirements listed in ASME Code Case N-577,[6] "Risk-Informed Requirements for Class 1, 2 or 3 Piping, Method A, Section XI,

[6] ASME Code Case N-577 has not been approved for use in RG-1.147, Revision 16. Licensees base their RI-ISI inspection sample size and examination methodology on Table 1 of ASME Code Case N-577.

Division 1," with more detailed provisions contained in WCAP-14572. The topical report includes a provision for requesting relief from volumetric examinations if 100 percent of the required volumes cannot be examined.

Table 1 of ASME Code Case N-577 assigns Examination Category R-A, Items R1.11 and R1.20, to piping inspection elements subject to thermal fatigue damage mechanism and elements not subject to a known damage mechanism, respectively. Table 1 in ASME Code Case N-577 requires 100 percent of the examination location volume, as described in ASME Code, Section XI, Figures IWB-2500-8(c), 9, 10, or 11, as applicable, including an additional ½-inch of base metal adjacent to the ASME Code volume, be completed for selected ASME Code, Class 1 piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100 percent of the ASME Code-required inspection volumes for Class 1 piping welds shown in Table 3.9.1 below.

Table 3.9.1 – ASME Code, Code Case N-577 Examination Category R-A

ASME Code Item	Weld ID	Weld Type	Coverage Obtained	CASS Base Material
R1.11	RCS-150-FW-2	2" Valve-to-Pipe	50.0%	None
R1.11	RCS-504A-FW-4	8" Pipe-to-Valve	50.0%	Valve
R1.11	RCS-504C-FW-4	8" Pipe-to-Valve	50.0%	Valve
R1.11	RCS-513-FW-25	3" Valve-to-Pipe	50.0%	Valve
R1.11	RCS-513-FW-29	3" Valve-to-Pipe	50.0%	Valve
R1.11	RCS-LP3-FW-27	6" Valve-to-Pipe	50.0%	None
R1.11	RHS-501-FW-3	12" Valve-to-Pipe	50.0%	None
R1.11	RHS-502-FW-3	12" Valve-to-Pipe	50.0%	None
R1.11	SIL-13-FW-5	6" Pipe-to-Valve	50.0%	None
R1.11	SIL-4-FW-10	10" Pipe-to-Valve	50.0%	None
R1.11	SIL-5-FW-10	10" Pipe-to-Valve	50.0%	None
R1.11	SIL-6-FW-10	10" Pipe-to-Valve	50.0%	Valve
R1.20	408044-FW-10-1	1.5" Pipe-to-Valve	50.0%	None
R1.20	408044-FW-5	1.5" Valve-to-Pipe	50.0%	None
R1.20	RCS-15-FW-28	27.5" Pipe-to-Valve	50.0%	Pipe/Valve
R1.20	RCS-5-FW-8	27.5" Pipe-to-Valve	50.0%	Pipe/Valve

Table 3.9.1 – ASME Code, Code Case N-577 Examination Category R-A				
ASME Code Item	Weld ID	Weld Type	Coverage Obtained	CASS Base Material
R1.20	RCS-10-FW-18	27.5" Pipe-to-Valve	50.0%	Pipe/Valve
R1.20	RCS-20-FW-38	27.5" Pipe-to-Valve	50.0%	Pipe/Valve
R1.20	RCS-LP2-HL1-SW-C	29" Pipe-to-Nozzle	50.0%	None
R1.20	RCS-LP4-FW-HL1-CMR	29" Pipe-to-Nozzle	50.0%	Pipe

Licensee's Basis for Relief Request

As stated by the licensee:

> Based on the configuration limited to single side access, relief is requested on, complying with the 100 percent required examination coverage for the piping welds listed in Table [3.9.1 above]. Note that examination coverage listed is that which was obtained during examination with no credit taken for the far side of each weld.
>
> Compliance with [ASME Code] requirements requires extensive modification or replacement of components with a design that allows examination from both sides of the weld. This option to meet the 100 percent examination coverage requirement is considered impractical due to cost, additional radiation exposure and impact to plant equipment.

Licensee's Proposed Alternative Examination:

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The examination requirements for the subject piping welds at MPS3 are governed by a RI-ISI program that was approved by the NRC in an SE dated March 12, 2002. This program assigns ASME Code Case N-577, Table 1, Examination Category R-A, Items R1.11 and R1.20 to piping elements subject to thermal fatigue damage mechanism and elements not subject to a known damage mechanism, respectively. The program requires inspection of 100 percent of the examination location volume for the subject circumferential piping welds. However, the design configurations of these welds limit volumetric examinations. In order to increase coverage, the welds would have to be re-designed and modified. This would place a burden on the licensee, therefore, the ASME Code-required volumetric examinations are considered impractical.

As shown in the technical descriptions and sketches provided in the licensee's submittals, examinations of the subject welds have been performed to the extent practical, with the licensee obtaining volumetric coverage of approximately 50% of the required volumes of the welds. The limitations encountered during the performance of the ultrasonic examinations were caused by cast stainless steel (CASS) materials and tapers of the valve or nozzle in the valve-to-pipe and pipe-to-nozzle weld configurations. These configurations limit the volumetric examinations primarily to the pipe side of the welds. The licensee evaluated potential additional examinations of welds in similar risk-informed segments and concluded that no additional volumetric coverage or no increase in the level of quality and safety would be provided by choosing other welds for examination.

Volumetric examinations on the subject welds were conducted with equipment, procedures and personnel that were qualified to the process outlined in ASME Code Section XI, Appendix VIII except for the welds containing CASS which followed ASME Code Section XI, Appendices I and III. These techniques have been qualified for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." For this reason, the licensee has taken credit for completing only 50% of the ASME Code-required inspection volumes on the subject piping welds. The licensee's ultrasonic scanning techniques included combinations of 45-, 60- and 70-degree shear, and/or refracted longitudinal waves (L-waves), as applicable, on many of the subject welds. L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds,[7,8] therefore, while the licensee has only taken credit for obtaining 50 percent volumetric coverage, the techniques employed would have provided coverage beyond the near-side of the welds. The ultrasonic examinations did not reveal any unacceptable flaws.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the design geometry of the welds and materials of construction. Based on the ultrasonic results and coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected by the examinations performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject components.

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7 F.V. Ammirato, X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

8 P. Lemaitre, T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

3.10 Request for Relief IR-2-60, ASME Code, Section XI, Examination Category B-P, Item B15.11, All Pressure Retaining Components

ASME Code Requirement

ASME Code, Section XI, Examination Category B-P, Item B15.11 requires all pressure retaining components be subject to a system hydrostatic test in accordance with ASME Code, Section XI, IWB-5222. The NRC has approved ASME Section XI Code Case N-498-4, "*Alternative Requirements for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems, Section XI, Division 1,*" that allows a system leakage test at or near the end of each inspection interval prior to reactor startup as an alternative to the 10-year system hydrostatic test required by ASME Code, Section XI, Table IWB-2500-1, Category B-P. The pressure retaining boundary for the test conducted at or near the end of each inspection interval shall be extended to all ASME Code, Class 1 pressure retaining components within the system boundary with a test pressure not less than the pressure corresponding with 100 percent rated reactor power. This extended boundary system leakage test is to be conducted once per inspection interval.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the system leakage test at a pressure corresponding to nominal operating pressure during system operation. The licensee proposed an alternative inspection in lieu of the system leakage test required under ASME Code, Section XI, IWB-5221 for the Reactor Vessel Head Flange Leak-Off Piping.

Licensee's Basis for Relief Request

As stated by the licensee:

> The [RPV] head flange seal leak detection piping is shown in Figures 1 and 2 in this attachment.[9] The piping is separated from the reactor coolant pressure boundary by one passive membrane, which is an O-ring located on the inner vessel flange. A second [O-ring] is located on the outside of the tap in the vessel flange. Failure of the inner O-ring is the only condition under which this line is pressurized. Therefore, the line is not expected to be pressurized during the system pressure test following a refueling outage.
>
> The configuration of this piping precludes system pressure testing while the [RPV] head is removed because the configuration of the [RPV] tap coupled with the high test pressure prevents the tap in the flange from being temporarily, plugged or connected to other piping. The opening in the flange is smooth walled, making the effectiveness of a temporary seal

[9] Figures 1 and 2 provided by the licensee are not included in this report.

very limited. Failure of a temporary test seal could possibly cause ejection of the device used for plugging or connecting to the [RPV] flange.

The configuration also precludes pressurizing the line externally with the head installed. The top head of the vessel contains two grooves that hold the [O-rings]. The [O-rings] are held in place by a series of retainer clips that are housed in recessed cavities in the flange-face. If a pressure test were to be performed with the head on, the inner [O-ring] would be pressurized in a direction opposite to its design function. This test pressure would result in a net inward force on the inner [O-ring] that would tend to push it into the recessed cavity that houses the retainer clips. The thin [O-ring] material would likely be damaged by the inward force.

Licensee's Proposed Alternative Examination

As stated by the licensee:

A VT-2 visual examination will be performed each outage on the unpressurized subject piping as part of the [ASME Code,] Class 1 leakage test. If the inner [O-ring] should leak during the operating cycle it will be identified by an increase in temperature of the leak-off line above ambient temperature which is an indication of [O-ring] seal leakage. This high temperature would actuate an alarm in the Control Room, which would be closely monitored by procedurally controlled operator actions allowing identification of any further compensatory actions required. This leakage would be collected in the primary drain transfer tank.

Additionally, the flange seal leak-off line is essentially a leakage collection/detection system and the line would only function as a [ASME Code,] Class 1 pressure boundary if the inner [O-ring] fails, thereby pressurizing the line. If any significant leakage does occur in the leak-off line piping itself during this time of pressurization, it would clearly exhibit boric acid accumulation and be discernable during the proposed VT-2 visual examination that will be performed unpressurized as proposed in this request.

NRC Staff Evaluation

The ASME Code requires that all ASME Code, Class 1 components within the reactor coolant system boundary undergo a system hydrostatic test at or near the end of each inspection interval. The NRC staff has accepted a system leakage test under ASME Code Case N-498-4 in lieu of the system hydrostatic test. However, the design configuration of the RPV head flange seal leak-off piping prevents performing the system leakage test at the ASME Code-required test pressure corresponding to the nominal operating pressure at 100 percent rated reactor power. The piping is part of a leakage detection system that is connected between the inner and the outer O-ring seals of the

RPV flange and the primary drain transfer tank. This system is required during plant operation to detect failure of the inner flange seal O-ring.

The design of the MPS3 RPV flange seal leak-off piping prevents pressurized system leakage testing. This piping (at the opening of the RPV flange) is smooth-walled, precluding test connections on this end, and empties into the primary drain tank, which may not be designed to accommodate primary system pressures. Also, the piping cannot be filled with water since there is no way of venting the entrapped air from the line. If it were possible to make a temporary seal and pressurize this piping, the inward force on the inner O-ring would push into the recessed cavities that house the retainer with the possibility of damaging the inner O-ring seal. To test the line to the required pressure would require that the system be re-designed and modified. Imposing this requirement would place a burden on the licensee, therefore, the ASME Code-required system leakage test is considered impractical.

The RPV flange seal leak-off line is basically a leakage collection and detection system. The line would only be pressurized if the inner O-ring fails and pressurizes the line. The failure of the inner O-ring would cause a rise in ambient temperature, activating an alarm in the reactor control room. The licensee also performs a visual VT-2, of the leak-off piping unpressurized before each refueling outage and at the end of each refueling outage. If any significant leakage in the piping had occurred during normal operation, it would exhibit boric acid accumulation that would be evident during this visual test.

The piping in question was examined at the beginning and end of each refueling outage during the second interval with no structural abnormalities or deficiencies being noted. Based on the visual VT-2 results during these unpressurized examinations, it is reasonable to conclude that, if significant service-induced degradation had occurred in the piping or within the flange seal leak-off piping and inner O-ring seal, evidence of it would have been detected by the examinations performed. The NRC staff determined that the licensee's VT-2 visual examinations performed each outage on the unpressurized subject piping as part of the ASME Code, Class 1 leakage test provides reasonable assurance of leak tightness of the subject components.

4.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittals and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in RRs IR-2-51 (in part)[10], IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-59, and IR-2-60. The NRC staff has concluded that based on the volumetric, surface and/or visual examination coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components.

Therefore, the NRC staff grants relief for the subject examinations of the components contained in RRs IR-2-51 (in part)[10], IR-2-52, IR-2-53, IR-2-54, IR-2-55, IR-2-56, IR-2-57, IR-2-59, and IR-2-60. The NRC staff has further determined that granting these RRs 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

[10] For 2 of the 4 items in RR IR-2-51 the licensee requested relief from the ASME Code, Section XI, Item B1.21 and B1.22 requirements. ASME Code, Section XI, Items B1.21 and B1.22 require the accessible length of the subject welds to be examined. The licensee stated in its request that the accessible length of the subject welds were examined. Therefore, the licensee met the ASME Code requirements for these welds and does not need relief from the ASME Code requirements.

For IR-2-58 the NRC staff concludes that performing the VT-3 examination of the RPV supports in accordance with the ASME Code, Section XI would require excessive personnel radiation exposure and poses a hardship for the licensee without a compensating increase in the level of quality and safety. Further, the NRC staff concludes that the licensee's alternative of performing a limited visual VT-3 examination on the exposed portions of the supports and the surrounding insulation provides reasonable assurance of structural integrity of the subject components. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC authorizes the use of limited visual VT-3 examination as an alternative to the ASME Code, Section XI, required VT-3 examination of the RPV supports for the second ISI interval at MPS3.

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

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Date: April 26, 2011

authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

For RR IR-2-58 the licensee, pursuant to 10 CFR 50.55a(a)(3)(ii), requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty.

For IR-2-58 the NRC staff concludes that performing the VT-3 examination of the reactor pressure vessel (RPV) supports in accordance with the ASME Code, Section XI would require excessive personnel radiation exposure and poses a hardship for the licensee without a compensating increase in the level of quality and safety. Further, the NRC staff concludes that the licensee's alternative of performing a limited visual VT-3 examination on the exposed portions of the supports and the surrounding insulation provides reasonable assurance of structural integrity of the subject components. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC authorizes the use of limited visual VT-3 examination as an alternative to the ASME Code, Section XI, required VT-3 examination of the RPV supports for the second ISI interval at MPS3.

If you have any question, please contact the Project Manager, 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. 50-423

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