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

June 30, 2010

Vice President, Operations
Entergy Operations, Inc.
Waterford Steam Electric Station, Unit 3
17265 River Road
Killona, LA 70057-3093

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – REQUEST FOR RELIEF NOS. WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, WF3-ISI-013, AND WF3-ISI-014 FROM ASME CODE, SECTION XI, EXAMINATION REQUIREMENTS FOR SECOND 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NOS. ME1426, ME1427, ME1428, ME1429, ME1430, ME1431, ME1432, AND ME1433)

Dear Sir or Madam:

By letter dated June 1, 2009, supplemented by letters dated November 6, 2009, February 8 and April 29, 2010, Entergy Operations Inc. (Entergy, the licensee), submitted Request for Relief (RR) Nos. WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, WF3-ISI-013 and WF3-ISI-014 from certain inservice inspection (ISI) requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, at Waterford Steam Electric Station, Unit 3 (Waterford 3). Specifically, the licensee requested relief from certain examination coverage requirements for selected components for the second 10-year ISI interval, which ended in April 2008.

By letter dated February 8, 2010, Entergy withdrew RR WF3-ISI-014 because it was determined that relief was not needed. Accordingly, the U.S. Nuclear Regulatory Commission (NRC) staff considers the request withdrawn and has closed NRC Task Assignment Control (TAC) No. ME1433. The letter dated April 29, 2010, was a resubmittal of a letter dated April 8, 2010, which had a page numbering discrepancy between Attachments 1 and 2. The letter dated April 29, 2010, in addition to correcting the discrepancy, also withdrew the relief requests for the Examination Category B–J, Item number B9.21 welds, contained in RR WF3-ISI-010.

The NRC staff has completed its review as documented in the enclosed Safety Evaluation. For certain stainless steel welds contained in RRs WF3-ISI-010 and WF3-ISI-013, the licensee employed only shear wave techniques from a single accessible side. In order to ensure that the volumetric examination coverage is maximized, it is recommended that the licensee apply both shear and longitudinal wave techniques on the subject welds during its next scheduled inspections for the components contained in RRs WF3-ISI-010 and WF3-ISI-013. While the staff did not include conditions on the approval of RRs WF3-ISI-010 and WF3-ISI-013, the licensee is recommended to contact the staff if further discussions are needed. Based on a review of the licensee's submittals, the NRC staff determined that compliance with the ASME Code-required examination coverage is impractical and that the achieved coverage provides reasonable assurance of structural integrity of the selected components. Therefore, pursuant to paragraph 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), relief is

granted for the second 10-year ISI interval for RRs WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, and WF3-ISI-013. The NRC staff concludes 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

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

If you have any questions, please contact Kaly N. Kalyanam, Project Manager for Waterford 3, at (301) 415-1480 or by e-mail at kaly.kalyanam@nrc.gov.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

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 INTERVAL INSERVICE INSPECTION PROGRAM

RELIEF REQUESTS NOS. WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010,

WF3-ISI-011, WF3-ISI-012, WF3-ISI-013, AND WF3-ISI-014

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By letter dated June 1, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML091540088), and supplemented by letters dated November 6, 2009, February 8 and April 29, 2010 (ADAMS Accession Nos. ML093160319, ML100470047, and ML101230324, respectively), Entergy Operations Inc. (Entergy, the licensee), pursuant to paragraph 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), requested relief from the inservice inspection (ISI) requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, pertaining to volumetric, surface, and visual examinations at Waterford Steam Electric Station, Unit 3 (Waterford 3) for selected components. Relief Request (RR) Nos. WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, WF3-ISI-013, and WF3-ISI-014 are for the second 10-year ISI interval. By letter dated February 8, 2010, Entergy withdrew RR WF3-ISI-014 because it was determined that relief was not needed. The letter dated April 29, 2010, was a resubmittal of a letter dated April 8, 2010, which had a page numbering discrepancy between Attachments 1 and 2. Because of the discrepancy, the letter dated April 8, 2010, was not docketed in ADAMS. The letter dated April 29, 2010, in addition to correcting the discrepancy, also withdrew the relief requests for the Examination Category B-J, Item number B9.21 welds, contained in RR WF3-ISI-010.

The U.S. Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has reviewed and evaluated the information provided by Entergy and adopts the evaluations and recommendations for granting relief contained in PNNL's Technical Letter Report (TLR) dated June 1, 2010 (ADAMS Accession No. ML101520318, non-publicly available), which has been incorporated into this safety evaluation (SE). The Attachment to this SE lists each relief request and the status of approval.

Enclosure

2.0 REGULATORY EVALUATION

Inservice inspection of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code, and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 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 preservice examination requirements, set forth in the ASME Code, Section XI, 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(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 Waterford 3 is the second 10-year interval ISI program, which ended in April 2008, is the 1992 Edition with 1993 Addenda of the ASME Code, Section XI.

3.0 TECHNICAL EVALUATION

The information provided by Entergy 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 in several parts according to the ASME Code Examination Category.

3.1 Request for Relief WF3-ISI-007, ASME Code, Section XI, Examination Category B-A, Items B1.22 and B1.40, Pressure Retaining Welds in Reactor Vessel (TAC No. ME1426)

3.1.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Item B1.22 requires essentially 100 percent volumetric examination, as defined by Figure IWB-2500-3, of the accessible length of reactor pressure vessel (RPV) meridional head welds. Item B1.40 requires essentially 100 percent volumetric and surface examination of the length of RPV head-to-flange welds, as defined by Figure IWB-2500-5. "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 1.147, Revision 15 (RG 1.147, Revision 15), "Inservice Inspection Code Case Acceptability."

3.1.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examination for the Class 1 RPV welds shown in Table 3.1.1.

Table 3.1.1 – ASME Code, Section XI, Examination Category B-A

ASME Code Item	Weld Identifier	Weld Type	ASME Coverage Obtained
B1.22	02-002	RPV Head Peel Segment-to-Peel Segment at 90°	18%
B1.22	02-003	RPV Head Peel Segment-to-Peel Segment at 0°	18%
B1.40	02-001	RPV Head-to-Flange	64%

3.1.3 Licensee's Basis for Relief Request (as stated by the licensee):

> During ultrasonic [(UT)] examination of the Pressure Retaining Reactor Vessel Welds listed in [Table 3.1.1] of this relief request, 100% coverage of the required examination volume could not be obtained.
>
> Radiography [(RT)] is not practical on these types of weld configurations, which prevents placement of the film and exposure source.

3.1.4 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.

3.1.5 NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examination, as applicable, of the accessible length of the RPV meridional head welds and head-to-flange welds. However, for the subject welds at Waterford 3, complete examinations are restricted by their design geometry and the proximity of surrounding appurtenances. The RPV would require design modifications and removal of adjacent components to increase the amount of weld volume that can be inspected. Imposing this requirement would place a burden on the licensee; therefore, the ASME Code-required 100 percent volumetric examinations are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, the Waterford 3 RPV closure head design includes a shroud surrounding the control rod drive housings and integrally-welded shroud support lugs that restricts access and transducer movement during scanning, and limits volumetric coverage for the meridional head welds to the lower 4 inches of each 22-inch weld length. The licensee obtained 18 percent volumetric coverage of the ASME Code-required inspection volumes for RPV Meridional Head Welds

02-002 and 02-003. Increasing volumetric coverage for these Welds 02-002 and 02-003 would require removing the shroud. The integral support lugs would, however, continue to limit the examinations. The weld examinations for ASME Code, Section XI, Item B1.22 were completed prior to the implementation of inspection techniques qualified under ASME Code, Section XI, Appendix VIII. Therefore, these examinations were conducted using ASME Code-required technical guidance at the time of the examinations. For RPV Closure Head-to-Flange Weld 02-001, the licensee obtained 64 percent volumetric coverage due to close proximity of the shroud supports and the flange configuration, which provides only limited access from the flange side of the weld. Manual UT examinations were conducted from the exterior surface of the RPV head with 0-degree longitudinal, and 45- and 60-degree shear wave techniques being applied. For ASME Code, Section XI, Item B1.40, the examination was performed to the ASME Code-required technical guidance at the time of the examination. Full coverage was achieved during the magnetic particle surface examination for Weld 02-001. No recordable indications were observed during any of the examinations.

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 their design and proximity of adjacent components. However, based on the volumetric and 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. The NRC staff concluded that the examinations were performed, to the extent practical, on the subject RPV welds, and provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.2 Request for Relief WF3-ISI-008, ASME Code, Section XI, Examination Category B-D, Items B3.110, B3.120, and B3.130, Full Penetration Welded Nozzles in Vessels (TAC No. ME1427)

3.2.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Items B3.110, B3.120, and B3.130 require 100 percent volumetric examination, as defined by ASME Code, Figures IWB-2500-7(a) through (d), as applicable, of Class 1 pressurizer nozzle-to-vessel welds, nozzle inside radius sections, and steam generator (SG) (primary side) nozzle-to-vessel welds, respectively. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, 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).

3.2.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examination of the subject nozzle-to-vessel welds and nozzle inside radius sections shown in Table 3.2.1 below:

Table 3.2.1- ASME Code, Section XI, Examination Category B-D

ASME Code Item	Weld Identifier	Weld Type	ASME Coverage Obtained
B3.110	05-009	Pressurizer Surge Nozzle-to-Head Weld	64%
B3.110	05-010	Pressurizer Spray Nozzle-to-Head Weld	74.8%
B3.110	05-011	Pressurizer Safety Nozzle-to-Head Weld	65.9%
B3.110	05-012	Pressurizer Safety Nozzle-to-Head Weld	65.9%
B3.110	05-013	Pressurizer Safety Nozzle-to-Head Weld	65.9%
B3.120	05-014	Pressurizer Surge Nozzle Inner Radius	29.4%
B3.120	05-015	Pressurizer Spray Nozzle Inner Radius	60.4%
B3.120	05-016	Pressurizer Safety Nozzle Inner Radius	72%
B3.120	05-017	Pressurizer Safety Nozzle Inner Radius	72%
B3.120	05-018	Pressurizer Safety Nozzle Inner Radius	72%
B3.130	03-010	42" Hot Leg Nozzle-to-SG#1	86.5%
B3.130	03-011	30" Cold Leg-to-SG#1 at 45°	66%
B3.130	03-012	30" Cold Leg-to-SG#1 at 315°	66%

3.2.3 Licensee's Basis for Relief Request (as stated by the licensee)

During ultrasonic examination of the Reactor and Pressurizer Vessel nozzle-to-vessel welds listed in [Table 3.2.1] of this relief request, 100% coverage of the required examination volume could not be obtained.

Radiography is not practical on these types of nozzle-to-vessel weld configurations, which prevent placement of the film and exposure source. To perform any additional Code allowable UT examination, modification and/or replacement of the component would be required. The examinations performed on the subject items in addition to the examination of other vessel welds contained in the ISI program would detect generic degradation, if it existed, therefore demonstrating an acceptable level of integrity.

3.2.4 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.

3.2.5 NRC Staff Evaluation

The ASME Code requires 100 percent volumetric examination of full penetration ASME Code Class 1 welded nozzles in the pressurizer and steam generators. However, the design geometry of the subject nozzle welds and nozzle inside radius sections limit UT scans. In order to effectively increase the examination coverage, these components would require design modifications or replacement. This would place a burden on the licensee; therefore, the ASME Code-required 100 percent volumetric examinations are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, examination of the subject nozzles and inside radius sections has been performed to the extent practical with the licensee obtaining aggregate volumetric coverage ranging from approximately 29 to 87 percent (see Table 3.2.1 above). The manual UT examinations on these carbon steel nozzle welds were performed from the outside of the pressurizer and SG, and included scans from the vessel shell using 0-degree longitudinal and 45-, 60-, and 70-degree shear waves, as applicable. 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 pressurizer vessel shell. This design geometry limits ASME Code-required UT angle beam examinations to the vessel side due to the curvature of the nozzle-to-vessel blend radii, which cause contact of the UT search unit to be interrupted. In addition, the pressurizer Safety Nozzle-to-Head Welds 05-011, 05-012, and 05-013 UT examinations were also limited 13 to 20 inches circumferentially due to the head-to-shell transition area.

UT examinations on SG Welds 03-011 and 03-012 were conducted with equipment, procedures, and personnel that were qualified to the process outlined in ASME Code, Section XI, Appendix VIII. The remaining examinations were performed prior to the required implementation of performance-based qualification techniques; therefore, these examinations were conducted in accordance with the applicable requirements of the ASME Code at the time of the examinations. No recordable indications were observed during any of the UT examinations. Although UT scans were primarily limited to the shell side only, recent studies have found that inspections conducted through carbon steel are equally effective whether the ultrasonic waves have only to propagate through the base metal, or have to also propagate through the carbon steel weldment[1]. Therefore, due to the fine-grained carbon steel microstructures, it is expected that the UT techniques employed would have detected structurally significant flaws that may have occurred on either side of the subject welds.

The licensee has shown that examining 100 percent of the ASME Code-required volumes of the subject nozzle-to-vessel welds and inside radius sections is impractical. However, based on the volumetric 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 on the subject welds provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

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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.

3.3 Request for Relief WF3-ISI-009, ASME Code, Section XI, Examination Category B-F, Item B5.40, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles ASME Code Requirement (TAC No. ME1428)

3.3.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-F, Item B5.40 requires 100 percent volumetric and surface examination, as defined by ASME Code, Figure IWB-2500-8, of nominal pipe size (NPS) 4-inch or larger nozzle-to-safe end dissimilar metal butt welds on vessel nozzles. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, 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).

3.3.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examination of ASME Code Class 1 welds shown in Table 3.3.1 below:

Table 3.3.1- ASME Code, Section XI, Examination Category B-F

ASME Code Item	Weld Identifier	Weld Type	ASME Coverage Obtained
B5.40	26-006	Pressurizer Nozzle to 8" x 6" Reducing Safe end Weld	63%
B5.40	26-001	Pressurizer Safety Nozzle to 8" x 6" Reducing Safe end Weld	70%

3.3.3 Licensee's Basis for Relief Request (as stated by the licensee)

During ultrasonic examination of the piping welds listed in Table 1 [Table 3.3.1 above] of this relief request, 100% coverage of the required examination volume could not be obtained.

Class 1 piping and components are often designed with welded joints such as nozzle-to-pipe, pipe-to-valve and pipe-to-pump which can physically obstruct a large portion of the required examination volume. For the welds listed in [Table 3.3.1] (above), the examinations were performed after November 22, 2002, the 10CFR50.55a mandatory implementation date for Appendix VIII of [ASME Code] Section XI, and code coverage percentages, provided, reflect what is currently allowed by qualified Appendix VIII techniques. Appendix VIII qualified (PDI [Performance Demonstration Initiative]) procedures have demonstrated that sound beams may potentially be attenuated and distorted when required to pass through austenitic weld metal. Still, the PDI qualified methods employ the best available technology for maximizing examination coverage of these types of welds. For the components listed in this relief request, examination was

extended to the far side of the weld to the extent permitted by geometry as qualified through PDI.

Entergy has used the best available techniques to examine the subject piping welds. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required. Consistent with the ASME [Code] Section XI sampling approach, examination of the subject welds, when combined with examinations that have been performed on other welds within the same Examination Category, is adequate to detect generic degradation, if it existed, therefore demonstrating an acceptable level of integrity.

3.3.4 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.

3.3.5 NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examinations for ASME Code, Section XI, Examination Category B-F pressure-retaining dissimilar metal welds in vessel nozzles. However, the design geometries of the subject pressurizer nozzle-to-safe end welds limits the UT scans. In order to effectively increase the examination coverage, these components would require design modification, or replacement. This would place a burden on the licensee, thus, 100 percent ASME Code-required UT examinations are considered impractical.

As shown on the sketches and technical descriptions included 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 63 percent and 70 percent for Pressurizer Safety and Spray Nozzles Welds 26-006 and 26-001, respectively. The tapering design geometry of the outside diameter safe end for Welds 26-001 and 26-006 limits the full ASME Code coverage from the safe-end side of the weld.

The UT examinations on the carbon steel (nozzle) and stainless steel (safe-end) welds conducted by the licensee included 45-degree shear wave and 45- and 60-degree refracted longitudinal waves (L-wave), where accessible. The L-wave technique is believed capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Studies[2,3] reported in the technical literature recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. These weld examinations were completed prior to the implementation of inspection techniques

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

[3] P. Lemaitre, T. D. Koble, and S. R. Doctor. 1995. "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, American Society of Mechanical Engineers.

qualified under Appendix VIII of the ASME Code, Section XI; therefore, these examinations were conducted using ASME Code-required technical guidance at the time of the examinations. No recordable indications were observed during any of the UT examinations.

Subsequent to these examinations, Welds 26-006 and 26-001 were mitigated using preemptive full structural weld overlays (see the SE for Request for Alternative W3-R&R-006, dated April 21, 2008, ADAMS Accession No. ML0809502731). In its letter dated May 29, 2008 (ADAMS Accession No. ML081540250), the licensee documented the UT examinations performed on the pressurizer weld overlays. For Weld 26-006, the UT examination resulted in 100 percent coverage of the weld overlay material and 93 percent coverage of the required volume for the dissimilar metal weld. For Weld 26-001, the UT examination resulted in 100 percent coverage of the weld overlay material and 91.7 percent coverage of the required volume for the dissimilar metal weld.

The licensee has shown that, prior to weld overlay, it was impractical to meet the ASME Code-required volumetric examination coverage for the subject piping welds due to the geometric configuration of the welds. Considering the volumetric coverage obtained prior to weld overlay, combined with the UT examination results obtained subsequent to weld overlay, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected. The NRC staff concluded that the examinations performed to the extent practical on the subject welds, along with the actions taken to mitigate these welds, provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.4 Request for Relief WF3-ISI-010, ASME Code, Section XI, Examination Category B-J, Items B9.11, B9.21, and B9.31, Pressure Retaining Welds in Piping (TAC No. ME1429)

3.4.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-J, Items B9.11 and B9.31, require essentially 100 percent volumetric and surface examinations, as defined by Figures IWB-2500-8, -9, -10, and -11, as applicable, for circumferential piping and branch connection welds 4-inch NPS, or larger, in diameter. ASME Code, Item B9.21 requires essentially 100 percent surface examination of the length of circumferential welds less than NPS 4-inch, as defined by ASME Code, Figure IWB-2500-8. "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 15.

3.4.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examination of the Class 1 piping welds shown in Table 3.4.1 below:

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

ASME Code Item	Weld Identifier	Weld Type	Weld/Base Material	ASME Coverage Obtained
B9.11	06-006	14" Shutdown Cooling Nozzle-to-Safe End Weld	Carbon/Alloy 82/182 to Stainless Steel (SS)	86.5%
B9.11	07-013	Reactor Coolant System (RCS) 30" Elbow to 45° Elbow Weld	Carbon	82.2%
B9.11	08-014	30" Pipe-to-Safe End Weld	Carbon/Alloy 82/182 to SS	71%
B9.11	09-002	SG Nozzle Ext. Piece to 30" Elbow Ext. Piece Weld	Carbon	87%
B9.11	09-005	45° Elbow to 30" Elbow Weld	Carbon	85%
B9.11	09-016	30" Elbow-to-Safe End Weld (Reactor Coolant Pump (RCP) 1B Inlet)	Carbon/Alloy 82/182 to SS	52.5%
B9.11	09-017	30" Safe End-to-RCP 1B Weld	SS/Cast SS	17.5%
B9.11	10-001	RCP 1B to 30" Safe End Weld	SS/Cast SS	18%
B9.11	10-002	Safe End to 30" Pipe Weld (RCP 1B Outlet)	Carbon/Alloy 82/182 to SS	44.2%
B9.11	13-001	SG#2 30" Nozzle-to-Nozzle Extension Weld	Carbon	62.5%
B9.11	17-033	12" Pipe-to-Reducer Weld	Stainless	57%
B9.11	19-006	12" Pipe-to-Valve Weld	Stainless	50%
B9.11	19-008	Valve End to 12" Pipe Weld	Stainless	50%
B9.11	21-066	14" Pipe-to-Valve Weld	Stainless	50%
B9.11	22-023	Elbow to 14" Pipe Weld	Stainless	88%
B9.11	25-009	4" Pipe to 4" x 4" x 3" Tee Weld	Stainless	75%
B9.11	25-015	4" x 4" x 3" Tee to 4" Pipe Weld	Stainless	75%
B9.11	25-016	4" Pipe-to-Valve End Weld	Stainless	50%
B9.11	25-018	Valve End to 4" Pipe Weld	Stainless	50%
B9.11	25-019	4" Pipe-to-Elbow Weld	Stainless	75%
B9.11	25-020	Elbow to 4" Pipe Weld	Stainless	75%
B9.11	25-022	Tee to 4" Branch Connection Weld	Stainless	62%
B9.11	26-002	8" x 6" Reducing Safe-End to 6" Elbow Weld	Stainless	50%

Table 3.4.1 – ASME Code, Section XI, Examination Category B-J				
ASME Code Item	**Weld Identifier**	**Weld Type**	**Weld/Base Material**	**ASME Coverage Obtained**
B9.11	26-007	8" x 6" Reducing Safe-End to 6" Elbow Weld	Stainless	52%
B9.31	08-008	12" Safety Injection Nozzle to 30" Pipe Weld	Carbon	50%

Note: In the licensee's response letter dated April 29, 2010, to the latest NRC Request for Additional Information (RAI), Entergy withdrew the request for relief for volumetric examination of the subject ASME Code, Item B9.21 pressure-retaining piping welds since volumetric examinations were performed to satisfy Owner Elected Exams, and not the requirements of ASME Code, Section XI. The licensee completed the ASME Code-required surface examinations on the subject welds. The request for relief from the ASME Code requirements was withdrawn for piping welds listed in Table 3.4.2 below:

Table 3.4.2 – ASME Code, Section XI, Examination Category B-J, Item B9.21		
Weld Identifier	**Weld Identifier**	**Weld Identifier**
15-006	27-011	28-012
27-002	27-037	28-013
27-004	27-038	28-016
27-005	27-054	28-074
27-006	27-055	28-075
27-007	28-001	28-076
27-008	28-002	28-077
27-009	28-008	28-078
27-010	28-009	

3.4.3 Licensee's Basis for Relief Request (as stated by the licensee)

During ultrasonic examination of the piping welds listed in [Table 3.4.1 above], 100% coverage of the required examination volume could not be obtained.

[ASME Code] Class 1 piping and components are often designed with welded joints such as nozzle-to-pipe, pipe-to-valve and pipe-to-pump which can physically obstruct a large portion of the required examination volume. For many of the welds listed in [Table 3.4.1], the examinations were performed after the 10CFR50.55a mandatory implementation date for Appendix VIII of [ASME Code,] Section XI, and [ASME Code] coverage percentages, provided, reflect what is currently allowed by qualified [ASME Code, Section XI,] Appendix VIII techniques. [ASME Code, Section XI,] Appendix VIII qualified PDI procedures have demonstrated that sound beams may potentially be attenuated and distorted when required to pass through austenitic weld metal. Still, the PDI qualified methods employ the best available technology for maximizing

examination coverage of these types of welds. For all the components listed in this relief request, examination was extended to the far side of the weld to the extent permitted by geometry, but this portion of the examination is not included in the reported coverage for welds examined under PDI and [ASME Code, Section XI,] Appendix VIII rules.

Entergy has used the best available techniques to examine the subject piping welds. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required. Consistent with the ASME [Code,] Section XI sampling approach, examination of the subject welds, when combined with examinations that have been performed on other welds within the same [ASME Code] Examination Category, is adequate to detect generic degradation, if it existed, therefore demonstrating an acceptable level of integrity.

3.4.4 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.

3.4.5 NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examinations for selected Examination Category B-J pressure-retaining welds in piping. However, complete volumetric examinations are restricted by several factors, including design, valve and branch connection configurations, and adjacent appurtenances. These conditions preclude the licensee from obtaining full volumetric examinations of these welds. To gain access for examination, the welds and adjacent items would require design modifications or component replacement. Imposition of this requirement would create a burden on the licensee; therefore, the ASME Code-required 100 percent volumetric examinations are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject welds have been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 18 to 88 percent (see Table 3.4.1 above). Various scan limitations in the axial and circumferential directions were caused by the surface angles on the varied weld configurations, and interfering adjacent components such as nozzles, pumps, and permanent support structures.

The UT examinations on the carbon and stainless steel welds conducted by the licensee included 45-, 60-, and 70-degree shear wave scan angles. In addition, the licensee performed 0-degree longitudinal, and 40-, 45-, 60-, and 70-degree refracted longitudinal wave (L-wave), as applicable, examinations from the accessible side for many of the welds. The L-wave technique is believed capable of detecting planar ID surface-breaking flaws on the far-side of wrought

stainless steel welds. Studies[4,5] reported in the technical literature recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. Many of the subject pipe weld volumetric examinations were conducted using manual techniques qualified in accordance with performance demonstration requirements listed in ASME Code, Section XI, Appendix VIII. However, for pipe Welds 06-006, 08-014, 09-016, 10-002, and 17-033, manual volumetric examinations were performed prior to the required implementation of performance-based qualification techniques; therefore these examinations were conducted in accordance with the applicable requirements of the ASME Code at the time of the examinations. The licensee also completed the ASME Code-required surface examinations (liquid penetrant and magnetic particle) on the subject pipe welds. No recordable indications were observed during any of the ultrasonic and surface examinations.

For the 30" Elbow-to Safe End Weld (RCP 1B Inlet) 09-016, and the Safe End to 30" Pipe Weld (RCP 1B Outlet) 10-002, 52.5 percent and 44.2 percent coverage was achieved, respectively. These examinations were performed with the manual UT techniques utilized prior to the required implementation of performance-based qualification techniques; therefore, these examinations were conducted in accordance with the applicable requirements of the ASME Code at the time of the examinations. Since the year 2000, when these examinations were performed, these welds were identified to be included a population of Alloy 82/182 welds that are subject to primary water stress-corrosion cracking. The nuclear power industry, through the Materials Reliability Program (MRP), developed guidance for inspection and evaluation of primary system piping butt welds in "Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline (MRP-139)," dated July 14, 2005 (non-proprietary version, MRP-139NP, available in ADAMS Accession No. ML052150196), requires licensees to inspect Alloy 82/182 butt welds such as these welds by December 31, 2010. The licensee performed the MRP-139 inspections of these two welds in the current interval using phased array ultrasonic techniques. For Weld 09-016, the examination achieved 100 percent coverage of the required axial and 83 percent of the circumferential coverage (excluding the cast stainless steel material as allowed by MRP-139). For Weld 10-002, the examination achieved 100 percent coverage of the required axial and 81 percent of the circumferential coverage (excluding the cast stainless steel material as allowed by MRP-139). No recordable indications were noted in either of these examinations. Though the coverage was limited on one side due to the cast stainless steel reactor coolant pump, the inspections achieved adequate coverage of the susceptible material to conclude that if significant service-induced degradation had occurred in these welds, evidence of it would have been detected.

For the 30" Safe End-to-RCP 1B Weld 09-017 and the RCP 1B to 30" Safe End Weld 10-001, the licensee reported coverage of 17.5 percent and 18 percent, respectively, for these stainless steel welds. The licensee's coverage calculations did not credit axial scans for circumferential flaws. However, in response to questions from the NRC staff during a telephone call with the

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

[5] P. Lemaitre, T. D. Koble, and S. R. Doctor. 1995. "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, American Society of Mechanical Engineers.

licensee on June 2, 2010, the licensee provided the data sheets for the inspections of these welds (ADAMS Accession No. ML101540478), which indicated that, in addition to the circumferential scans that resulted in the coverage reported, full axial scans were completed in two directions. No indications were detected in these scans.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject piping welds due to the geometry configuration of the welds and proximity of other components. Considering the volumetric coverage obtained, along with the surface examinations performed, it is reasonable to conclude that if significant service-induced degradation had occurred in the subject welds, evidence of it would have been detected. Furthermore, the NRC staff concluded that the examinations performed to the extent practical on the subject welds provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.5 Request for Relief WF3-ISI-011, ASME Code, Section XI, Examination Category C-A, Items C1.10 and C1.20, Pressure Retaining Welds in Pressure Vessels (TAC No. ME1430)

3.5.1 ASME Code Requirement

ASME Code, Section XI, Examination Category C-A, Items C1.10 and C1.20 require essentially 100 percent volumetric examination, as defined by Figure IWC-2500-1, of the length of shell and head circumferential welds in Class 2 pressure vessels. "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 15.

3.5.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examinations of the Class 2 pressure-retaining welds shown in Table 3.5.1 below.

Table 3.5.1 – ASME Code, Section XI, Examination Category C-A

ASME Code Item	Weld Identifier	Weld Type	ASME Coverage Obtained
C1.10	04-026	SG Intermediate Shell-to-Conical Shell Weld	56%
C1.20	04-029	SG#2 Top Head Torus-to-Top Head Dome Weld	89%
C1.20	54-074	Shut Down Heat Exchanger Shell-to-Flange Weld	88%
C1.20	54-075	Shut Down Heat Exchanger Shell-to-Flange Weld	85%

3.5.3 Licensee's Basis for Relief Request (as stated by the licensee)

During ultrasonic examination of the piping welds listed in [Table 3.5.1] of this relief request, 100% coverage of the required examination volume could not be obtained.

Class 1 piping and components are often designed with welded joints such as nozzle-to-pipe, pipe-to-valve and pipe-to-pump which can physically obstruct a large portion of the required examination volume. For the welds listed in [Table 3.5.1] (above), the examinations were performed after November 22, 2002, the 10CFR50.55a mandatory implementation date for Appendix VIII of Section XI, and code coverage percentages, provided, reflect what is currently allowed by qualified Appendix VIII techniques. Appendix VIII qualified (PDI) procedures have demonstrated that sound beams may potentially be attenuated and distorted when required to pass through austenitic weld metal. Still, the PDI qualified methods employ the best available technology for maximizing examination coverage of these types of welds. For the components listed in this relief request, examination was extended to the far side of the weld to the extent permitted by geometry as qualified through PDI.

Entergy has used the best available techniques to examine the subject piping welds. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required. Consistent with the ASME Section XI sampling approach, examination of the subject welds, when combined with examinations that have been performed on other welds within the same Examination Category, is adequate to detect generic degradation, if it existed, therefore demonstrating an acceptable level of integrity.

3.5.4 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.

3.5.5 NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of ASME Code Class 2 vessel circumferential head and shell welds. However, for the subject welds on the SG and shut down heat exchanger, complete examinations are restricted by the design configuration and the proximity of adjacent appurtenances. Achieving greater coverage on these welds would require that these SG and heat exchanger welds 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 submittal, examinations of the SG and shut down heat exchanger shell and head circumferential welds have been performed to the extent practical with aggregate volumetric coverage ranging from

approximately 56 to 89 percent of the ASME Code-required volumes. The SG and shut down heat exchanger are fabricated of carbon steel and stainless steel, respectively.

The licensee performed manual UT examinations on SG Welds 04-026 and 04-029 from the shell side using 0-degree longitudinal, as applicable, and 45- and 60-degree shear waves to achieve limited circumferential and axial coverage along the weld length. Scans from the opposite side of the welds were limited due to the proximity of the welded insulation support ring and the insulation lugs located 3.5 inches from the weld centerline. SG Weld 04-029 was limited further due to the surface angle on the weld configuration. Removal of the insulation support ring would increase dose to personnel and only increase volumetric coverage by approximately 2 percent. Although UT scans were limited to the shell side of the welds only, 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.[6] 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 weld due to the fine-grained carbon steel microstructures in these materials. In addition, a surface examination (liquid penetrant) was performed on Intermediate Shell-to-Conical Shell Weld 04-026.

The licensee performed manual UT examinations on the Shut Down Heat Exchanger "B" Shell-to-Flange Welds 54-074 and 54-075, including scans from the shell side using 70-degree refracted longitudinal (L-wave), and 45- and 60-degree shear waves to achieve limited circumferential and axial coverage along the weld length. UT scans were restricted by two nozzle reinforcement pads welded to the vessel shell at 0 and 180 degrees and the proximity of the flange. The L-wave technique is believed capable of detecting planar ID surface-breaking flaws on the far-side of wrought stainless steel welds. Studies[7,8] reported in the technical literature recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds.

The subject Class 2 pressure-retaining weld volumetric examinations were conducted in accordance with the applicable requirements of the ASME Code at the time of the examinations. No recordable flaw indications were observed during any of the examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject shell and head circumferential welds due to geometry configuration and interference from surrounding components. Based on the volumetric and 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

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

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

[8] P. Lemaitre, T. D. Koble, and S. R. Doctor. 1995. "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, American Society of Mechanical Engineers.

examinations that were performed. Furthermore, the NRC staff concluded that the examinations performed to the extent practical on the subject welds provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.6 Request for Relief WF3-ISI-012, ASME Code, Section XI, Examination Category C-B, Item C2.21, Pressure Retaining Nozzle Welds in Vessels (TAC No. ME1431)

3.6.1 ASME Code Requirement

ASME Code, Section XI, Examination Category C-B, Item C2.21 requires 100 percent volumetric and surface examination, as defined by ASME Code, Figure IWC-2500-4(a) or (b), as applicable, of nozzle-to-shell (or head) welds in Class 2 vessels. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, 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).

3.6.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric and surface examination shown in Table 3.6.1 below.

Table 3.6.1 – ASME Code, Section XI, Examination Category C-B

ASME Code Item	Weld Identifier	Weld Type	ASME Coverage Obtained
C2.21	04-030	SG#2 Main Steam Nozzle to-Top Head Dome Weld	86%

3.6.3 Licensee's Basis for Relief Request (as stated by the licensee)

> During ultrasonic examination of the piping welds listed in [Table 3.6.1], 100 percent coverage of the required examination volume could not be obtained.
>
> [ASME Code] Class 1 piping and components are often designed with welded joints such as nozzle-to-pipe, pipe-to-valve and pipe-to-pump which can physically obstruct a large portion of the required examination volume. For the welds listed in [Table 3.6.1] (above), the examinations were performed after November 22, 2002, the 10 CFR 50.55a mandatory implementation date for Appendix VIII of [ASME Code] Section XI, and code coverage percentages, provided, reflect what is currently allowed by qualified [ASME Code] Appendix VIII techniques. [ASME Code] Appendix VIII qualified (PDI) procedures have demonstrated that sound beams may potentially be attenuated and distorted when required to pass through austenitic weld metal. Still, the PDI qualified methods employ the best available technology for maximizing examination coverage of these types of welds. For the components listed in this

relief request, examination was extended to the far side of the weld to the extent permitted by geometry as qualified through PDI.

Entergy has used the best available techniques to examine the subject piping welds. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required. Consistent with the ASME [Code] Section XI sampling approach, examination of the subject welds, when combined with examinations that have been performed on other welds within the same [ASME Code] Examination Category, is adequate to detect generic degradation, if it existed, therefore demonstrating an acceptable level of integrity.

3.6.4 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.

3.6.5 NRC Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination of ASME Code Class 2 nozzle-to-shell (or head) welds. However, for SG Nozzle-to-Top Head Dome Weld 04-030, complete examination is limited due to the nozzle configuration and adjacent appurtenances. In order to achieve greater volumetric coverage, the nozzle and vessel would have to be redesigned and modified. This would place a burden on the licensee; therefore, the ASME Code volumetric examination is considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittal, examination of the carbon steel Nozzle-to-Top Head Dome Weld 04-030 was performed to the extent practical, with the licensee obtaining 86 percent of the required examination volume, including 0-degree longitudinal, and 45- and 60-degree shear wave scans from the shell side of the weld. The SG is fabricated of carbon steel material with a nominal thickness of 5.5 inches. The nozzle's "set-in" design essentially makes the weld a concentric ring aligned parallel with the nozzle axis. For this reason, no scans could be performed from the nozzle side of the weld. In addition, the proximity of welded insulation lugs, located 5.25 inches from the weld centerline, on the shell side interrupted circumferential ultrasonic scanning. The manual UT examinations were performed in accordance with the applicable requirements of the ASME Code at the time of the examinations. No unacceptable indications were noted during the UT examinations. Although UT scans were primarily limited to the shell side only, 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[9]. Therefore, due to the fine-grained carbon steel microstructures, it is expected that the UT techniques employed would have detected structurally significant flaws that may have occurred on either side of the subject welds.

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

As documented in the licensee's corrective action process, CR-WF3-2010-0352, the licensee did not perform the ASME Code-required surface examination for Nozzle-to Shell Weld 04-030. However, no recordable indications were observed in the last surface examination of the subject Weld 04-030. In addition, the 7.5 percent examination population of ASME Code Class 2 nonexempt piping welds in accordance with ASME Code, Section XI for Class 2 systems, was met. The subject weld will not be inspected in the next refueling outage since the respective SG will be replaced at this time. As stated by the licensee, the missed surface examination on Weld 04-030 was an isolated event and not reportable pursuant to 10 CFR 50.73, "Licensee event report system."

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject nozzle-to-shell weld due to the nozzle design configuration. However, based on the volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would be have been detected by the examinations performed. Furthermore, the NRC staff concluded that the examinations performed to the extent practical on the subject welds provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.7 Request for Relief WF3-ISI-013, 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 (TAC No. ME1432)

3.7.1 ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, require 100 percent volumetric and surface examinations, as defined by ASME Code, Figure IWC-2500-7, of selected 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 15, 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).

3.7.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(6)(i), the licensee requested relief from the ASME Code-required volumetric examinations of the circumferential 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 Identifier	Weld Type	Pipe Size-Thickness	ASME Coverage Obtained
C5.11	55-051	8" Pipe-to-Valve Weld	8.0" - 0.719"	45.5%
C5.11	64-001	Valve to 10" Pipe Weld	10.0" - 0.365"	50%
C5.11	56-001	LPSI [low-pressure spray injection] Valve to 10" Pipe Weld	10.0" - 0.365"	50%

Table 3.7.1 - ASME Code, Section XI, Examination Category C-F-1				
ASME Code Item	**Weld Identifier**	**Weld Type**	**Pipe Size-Thickness**	**ASME Coverage Obtained**
C5.11	56-002	LPSI 10" Pipe-to-Tee Weld	10.0" - 0.365"	50%
C5.11	56-003	LPSI Tee to 10" Pipe Weld	10.0" - 0.365"	50%
C5.11	61-071	14" x 8" Reducing Elbow-to-Flange Weld	8.0" - 0.80"	50%
C5.11	55-001	10" Valve-to-Stainless Pipe Weld	10.0" - 0.365"	50%
C5.11	56-005	Tee to 10" Pipe Weld	10.0" - 0.365"	50%
C5.11	54-043	10" Pipe to 10" x 6" Reducer Weld	10.0" - 0.325"	50%
C5.11	56-077	8" Pipe-to-Cont. Penetration Weld	8.0" - 0.80"	50%
C5.11	52-004	14" Elbow-to-Tee Weld	14.0" - 1.14"	50%
C5.21	60-131	4" Pipe-to-Tee	4.0" - 0.438"	79%
C5.21	60-468	3" Elbow-to-Pipe Weld	3.0" - 0.438"	50%
C5.21	60-469	Pipe-to-Penetration Weld	3.0" - 0.44"	50%

3.7.3 Licensee's Basis for Relief Request (as stated by the licensee)

During the 2nd 10-year ISI interval at WF3 [Waterford 3], 10 CFR 50.55a(g)(6)(ii)(C) mandated an implementation schedule for all licensees to begin use of Appendix VIII of the 1995 Edition, with 1996 Addenda of ASME [Code] Section XI. As a result, the examinations listed in this relief request were performed utilizing procedures written in accordance with the PDI Generic UT Procedures and Appendix VIII. With the implementation of [ASME Code] Appendix VIII, only ½ Vee path examinations have been allowed to be used in austenitic materials, and angle beams are no longer credited to extend beyond the centerline of austenitic welds for consideration of Code coverage, in accordance with qualified PDI procedures. Additional discussion, as to the examination coverage determination process when using [ASME Code] Appendix VIII techniques on single-sided austenitic welds, is provided in Section III of this relief request.

3.7.4 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.

3.7.5 NRC Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination of selected ASME Code, Section XI, Examination Category C-F-1 pressure-retaining circumferential piping welds.

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, which restricts scanning to one side only. To gain access for examination, the welds 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 submittal, examinations of the subject welds have been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 46 to 79 percent. Access for examination of the subject piping welds is limited to the pipe or elbow side only due to the surface angle caused by the elbow-to-tee, valve-to-pipe, pipe-to-reducer, flange-to-reducer, or tee-to-pipe weld configurations (see Table 3.7.1 above). The UT techniques employed for all but one of these stainless steel welds have been qualified through the industry's PDI Program, which meets ASME Code, Section XI, Appendix VIII requirements. However, for Pipe-to-Valve Weld 55-051, manual volumetric examinations were performed in accordance with the applicable requirements of the ASME Code at the time of the examinations.

Depending on the piping wall thickness (see Table 3.7.1 above), 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, which have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds[10,11]. While the licensee has only taken credit for obtaining 50% volumetric coverage for the majority of the subject piping welds, the techniques employed would have provided coverage beyond the near-side of the welds. A review of the typical weld cross-sectional information indicates that limited volumetric coverage on the far-side of the welds has been obtained by the licensee. The licensee also completed surface examinations (liquid penetrant) on several of these welds. No recordable indications were noted during the performance of the volumetric and surface examinations.

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 geometric configuration. 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 were occurring, evidence of it would have been detected by the volumetric and surface examinations that were performed. Furthermore, the NRC staff concluded that the examinations concluded to the

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

[11] P. Lemaitre, T. D. Koble, and S. R. Doctor. 1995. *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, American Society of Mechanical Engineers.

extent practical on the subject welds provide reasonable assurance of structural integrity of the subject welds and is, therefore, acceptable.

3.8 Request for Relief WF3-ISI-014, ASME Code, Section XI, Examination Category R-A, Items R1.20, Alternative Piping Classification and Examination Requirements (TAC No. ME1433)

By letter dated February 8, 2010, Entergy withdrew RR WF3-ISI-014 because it was determined that it is not needed. Therefore, there is no further discussion of RR WF3-ISI-014 in this SE.

4.0 CONCLUSIONS

For certain stainless steel welds contained in RRs WF3-ISI-010 and WF3-ISI-013, the licensee employed only shear wave techniques from a single accessible side. In order to ensure that the volumetric examination coverage is maximized, the NRC staff recommends that the licensee apply both shear and longitudinal wave techniques on the subject welds during its next scheduled inspections for the components contained in RRs WF3-ISI-010 and WF3-ISI-013. While the staff did not include conditions on the approval of RRs WF3-ISI-010 and WF3-ISI-013, the licensee is recommended to contact the staff if further discussions are needed.

The NRC staff has reviewed the licensee's submittal and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in RRs WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, and WF3-ISI-013. The NRC staff further concludes that, based on the volumetric and surface examination coverage obtained on the subject 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. Based on the above, the staff concludes that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds.

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), and is in compliance with the requirements of 10 CFR 50.55a with the granting of these reliefs. Therefore, the NRC staff grants relief for the subject examinations of the components contained in RRs WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, and WF3-ISI-013 for Waterford 3 for the second 10-year ISI interval which ended in April 2008. The staff has further concluded 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.

RR WF3-ISI-014 was withdrawn by the licensee by letter dated February 8, 2010. Therefore, the NRC staff did not review RR WF3-ISI-014.

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

Principal Contributors: Thomas McLellan
Carol Nove

Date: June 30, 2010

Attachment

WATERFORD STEAM ELECTRIC STATION, UNIT 3
Second 10-Year ISI Interval
TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	TLR RR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
WF3-ISI-007	3.1	Pressure Retaining Welds in Reactor Vessel	B-A	B1.22 B1.40	100% of Class 1 RPV meridional head, and head-to-flange welds	Volumetric and Surface, as applicable	Use volumetric and surface (as applicable) coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
WF3-ISI-008	3.2	Full Penetration Welded Nozzles in Vessels	B-D	B3.110 B3.120 B3.130	100% of Class 1 Pressurizer nozzle-to-vessel, nozzle inside radius section, and SG nozzle-to-vessel welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
WF3-ISI-009	3.3	Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles	B-F	B5.40	100% of Class 1 Pressurizer, NPS 4-inch or larger, nozzle-to-safe end butt welds	Volumetric and Surface	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
WF3-ISI-010	3.4	Pressure Retaining Welds in Piping	B-J	B9.11 B9.21 B9.31	100% of Class 1 circumferential piping, and branch pipe connection welds	Surface and Volumetric, as applicable	Use volumetric and surface coverage achieved	Granted 10 CFR 50.55a(g)(6)(i) Item B9.21 withdrawn by licensee
WF3-ISI-011	3.5	Pressure Retaining Welds in Pressure Vessels	C-A	C1.10 C1.20	100% of Class 2 shell and head circumferential welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
WF3-ISI-012	3.6	Pressure Retaining Nozzle Welds in Vessels	C-B	C2.21	100% of Class 2 nozzle-to-shell welds	Volumetric and Surface	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
WF3-ISI-013	3.7	Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping	C-F-1	C5.11 C5.21	100% of Class 2 circumferential piping welds	Volumetric and Surface	Use volumetric and surface (as applicable) coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)

granted for the second 10-year ISI interval for RRs WF3-ISI-007, WF3-ISI-008, WF3-ISI-009, WF3-ISI-010, WF3-ISI-011, WF3-ISI-012, and WF3-ISI-013. The NRC staff concludes 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

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

If you have any questions, please contact Kaly N. Kalyanam, Project Manager for Waterford 3, at (301) 415-1480 or by e-mail at kaly.kalyanam@nrc.gov.

Sincerely,

/RA/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
As stated

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