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

April 30, 2010

Mr. Michael J. Annacone, Vice President
Brunswick Steam Electric Plant
Carolina Power & Light Company
Post Office Box 10429
Southport, North Carolina 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1 - RELIEF REQUESTS RR-42, RR-43, RR-44, AND RR-45 FOR THE THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN (TAC NOS. ME1143, ME1144, ME1145, AND ME1146)

Dear Mr. Annacone,

By letter dated April 27, 2009, as supplemented by letters dated November 20, 2009, and February 3, 2010, Carolina Power & Light Company (the licensee) submitted requests RR-42, RR-43, RR-44, and RR-45, requesting relief from the 100 percent coverage of weld volume or area examinations requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) during the third 10-year inservice inspection (ISI) interval, which ended on May 10, 2008, at Brunswick Steam Electric Plant, Unit 1 (BSEP-1).

The Nuclear Regulatory Commission (NRC) staff has evaluated the licensee's relief requests and concluded that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i). The NRC staff has further determined that granting these relief requests is in compliance with the requirements of 10 CFR 50.55a, and is therefore 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. Therefore, the NRC grants relief for the subject examinations of the components contained in relief requests RR-42, the revised RR-43, RR-44 (ASME Code Examination Category B-A, Item B1.30 for reactor pressure vessel (RPV) shell-to-flange welds), and RR-45 for the Third 10-year ISI interval at BSEP-1. For RR-44, ASME Code, Examination Category B-A, Item B1.22, the NRC staff concluded that the licensee has met the ASME Code requirements and does not require relief for the bottom head meridional welds (1B11-RPV-J31 and 1B11-RPV-J42).

The NRC staff's safety evaluation is enclosed. If you have any questions regarding this matter, please contact Farideh Saba at (301) 415-1447.

Sincerely,

Douglas A. Broaddus, Acting Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-325

Enclosure: Safety Evaluation

cc w/enclosure: Distribution via ListServ

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

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

RELIEF REQUESTS RR-42, RR-43, RR-44, AND RR-45

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1

DOCKET NUMBER 50-325

1.0 INTRODUCTION

By letter dated April 27, 2009, Carolina Power & Light Company (the licensee) submitted requests RR-42, RR-43, RR-44, and RR-45 requesting reliefs from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirements associated with the third 10-year inservice inspection (ISI) interval at Brunswick Steam Electric Plant, Unit 1 (BSEP-1). Additionally, by letters dated November 20, 2009, and February 3, 2010, in response to the Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI), the licensee submitted additional information for relief requests RR-42, RR-43, RR-44, and RR-45, and revised relief request RR-43.

2.0 REGULATORY REQUIREMENTS

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for 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.

Alternatives to the requirements may be authorized or relief granted by the NRC pursuant to 10 CFR 50.55a(a)(3)(i), 10 CFR 50.55a(a)(3)(ii), or 10 CFR 50.55a(g)(6)(i). In proposing alternatives or requests for relief, the licensee must demonstrate that: (1) the proposed alternatives would provide an acceptable level of quality and safety; (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for the facility.

Furthermore, 10 CFR 50.55a(g)(5)(iii) states: "If the licensee has determined that conformance with certain code requirements is impractical for its facility, the licensee shall notify the [Nuclear

Regulatory] Commission and submit, as specified in 10 CFR 50.4, information to support the determinations."

Paragraph (g)(5)(iv) of 10 CFR 10 CFR 50.55a states:

> Where an examination requirement by the code or addenda is determined to be impractical by the licensee and is not included in the revised inservice inspection program as permitted by paragraph (g)(4) of this section, the basis for this determination must be demonstrated to the satisfaction of the Commission not later than 12 months after the expiration of the initial 120-month period of operation from start of facility commercial operation and each subsequent 120-month period of operation during which the examination is determined to be impractical.

Pursuant to 10 CFR 50.55a(g)(6)(i):

> The Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The ASME Code of record for third 10-year Interval ISI Program at the BSEP-1, which ended on May 11, 2008, is Section XI 1989 Edition, no Addenda.

3.0 TECHNICAL EVALUATION

By letter dated April 27, 2009, the licensee submitted four relief requests, RR-42, RR-43, RR-44, and RR-45 for the BSEP, Unit 1. On September 23, 2009, the NRC staff provided an electronic version of an RAI concerning the proposed ISI program alternatives. By letter dated November 20, 2009, the licensee responded to the NRC staff's RAI for the four relief requests. On January 12, 2010, a telephone conference was conducted between the NRC staff and the licensee to discuss the licensee's response to the NRC staff's RAI. During the discussions, the licensee identified two welds listed in Table 2 of the November 20, 2009, letter for which Code-required examination coverage was achieved. As a result, the licensee indicated those two welds, 1G3115-1-15-FWRWCUB2A and 1B2IN4D-5-SW 1-2, would be removed from the Table 2 weld list, since relief for those welds is not required.

The licensee in its letter dated February 3, 2010, stated that during review of the remaining welds on Table 2 of the November 20, 2009, submittal, it determined that a total of 18 welds in RR-43 were incorrectly categorized as ASME Code Items and included in the request. The licensee's review confirmed that the examinations of these welds met the requirements of the augmented ISI program for intergranular stress corrosion cracking (IGSCC) inspections and that these weld inspections were not required to satisfy ASME Code, Section XI inspection requirements. The licensee stated that it removed these 18 welds from the original Table 2 weld list, since relief is no longer needed for them. The revised Table 2 in the February 3, 2010

submittal shows only those welds that meet the examination requirements of the ASME Code, Section XI. The welds that are removed from RR-43 are listed in Table 3.0.1. The welds removed from RR-43 will not be discussed further in this safety evaluation (SE).

Table 3.0.1 – Welds Removed from RR-43		
1B32RECIRC-28-A-11	1B32RECIRC-28-A-8	1B32RECIRC-22-AM-5BCA
1B32RECIRC-28-A-9	1B11N8A-JPI-FWR122-1	1B32FFE-12-FWRRB14A
1B21N4D-5-FWN4D315-3	1B21N4D-5-SW1-2	1B32RECIRC-22-AM-4
1B32RECIRC-22-BM-5	1B32RECIRC-28-A-13	1B32RECIRC-28-A-5
1B32RECIRC-28-B-11	1B32RECIRC-28-B-15BC	1B32RECIRC-28-B-2
1B32RECIRC-28-B-9	1B32RECIRC-28-B-16	1B32RS2B2-10-FWB39
1G3115-1-15-FWRWCUB2A	1B32FFG-12-FWRRA11A	

During the January 12, 2010, discussions, the NRC staff also asked for a clarification of the IGSCC categories used in relief request RR-43 to describe the various weldments. The licensee explained that a unique number for IGSCC categorizations is assigned at BSEP. However, the licensee revised the IGSCC categories cited in RR-43 to remove the BSEP-specific number. As a result, the IGSCC categories cited in the weld-specific descriptions now coincide with the industry standard for IGSCC categorizations.

The information provided by the licensee in support of the requests for relief from, or alternatives to, ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the licensee's request has been evaluated in several parts according to ASME Code Examination Category, as needed. The attached table to this SE lists each relief request and the status of approval.

3.1 Request for Relief RR-44, ASME Code, Section XI, Examination Category B-A, Items B1.22 and B1.30, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Item B1.22 requires essentially 100 percent volumetric examination, as defined by ASME Code, Section XI, Figure IWB-2500-3 of the accessible length of reactor pressure vessel (RPV) meridional head welds. ASME Code, Section XI, Examination Category B-A, Item B1.30 requires essentially 100 percent volumetric examination, as defined by ASME Code, Section XI, Figure IWB-2500-4 of the length the RPV shell-to-flange weld. "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 (RG 1.147), Revision 15, "Inservice Inspection Code Case Acceptability."

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volumes for the RPV pressure retaining welds shown in Table 3.1.1.

Table 3.1.1 – ASME Code, Section XI, Examination Category B-A			
ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B1.22	1B11-RPV-J31	Bottom Head Meridional Weld	8.9%
B1.22	1B11-RPV-J42	Bottom Head Meridional Weld	8.9%
B1.30	1B11-RPV-F1	RPV Shell-to-Flange Weld	64.0% (0-180 deg)
B1.30	1B11-RPV-F2	RPV Shell-to-Flange Weld	64.0% (180-360 deg)

Licensee's Basis for Relief Request

Welds 1B11-RPV-J31 and 1B11-RPV-J42

The licensee in the letter dated April 27, 2009, stated that RPV bottom head meridional welds (1B11-RPV-J31 and 1B11-RPV-J42) extend meridionally from one side of the hemispherical bottom head to the other. Each weld is approximately 213 inches in length. The RPV sits on an approximately 194-inch diameter integrally welded support skirt. This support skirt obstructs approximately 194 inches of each of the bottom head welds.

The licensee also stated that during the third 10-year ISI interval an ultrasonic (UT) examination was performed and achieved 8.9 percent of the ASME Code-required coverage on each of the welds. This coverage is the maximum extent practical because access to the inside of the support skirt is not possible. The licensee added that during each refueling outage a VT-2 examination (a nondestructive, visual examination technique in accordance with ASME Code, Section XI) was performed in conjunction with system pressure testing. Due to the configurations of these components, UT examinations are limited to scanning on the accessible areas outside the reactor vessel support skirt and control rod drives (CRDs). Furthermore, the licensee stated that compliance with the examination coverage requirements of the ASME Code, Section XI would require modification, redesign, or replacement of components where geometry is inherent to the component design.

Welds 1B11-RPV-F1/1B11-RPV-F2

The licensee in the letter dated April 27, 2009, stated that RPV flange-to-upper shell weld (1B11-RPV-F1 and 1B11-RPV-F2) is one weld, which has been assigned two identification numbers for tracking purposes. Weld W1B11-RPV-F1/F2 is a

circumferential weld that attaches the RPV flange-to-the upper shell. Weld 1B11-RPV-F1 designates the portion of the weld from 0 to 180 degrees and weld 1B11-RPV-F2 designates the portion of the weld from 180 to 360 degrees.

The licensee also stated that during the third 10-year interval, a UT examination was performed, to the extent practical, in accordance with ASME Code, Section XI. These weld examinations were completed prior to the implementation of inspection techniques qualified under Appendix VIII of ASME Code, Section XI, administered by the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI). As shown on Figure 2 of the licensee's submittal dated April 27, 2009, the examination achieved 64 percent of the ASME Code-required coverage on the weld. In addition, each refueling outage, a VT-2 examination is performed in conjunction with system pressure testing. Reactor coolant system leak rate limitations and atmospheric particulate radioactivity monitoring also ensures that any leakage would be detected prior to gross failure.

Furthermore, the licensee stated that the design configuration makes compliance with the ASME Code-required examination coverage requirements impractical. RPV modifications would be needed to meet the ASME Code requirements, which would impose a considerable burden on BSEP, Unit 1.

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

RPV Bottom Head Meridional Welds 1B11-RPV-J31 and 1B11-RPV-J42

The ASME Code requires essentially 100 percent volumetric examination the accessible length of the RPV bottom head meridional welds. The examinations are limited due to the RPV support skirt and CRD housings that are adjacent to the support skirt and subject weld.

As shown in the sketches and technical descriptions included in the licensee's submittals dated April 27 and November 20, 2009, examinations of the welds listed in Table 3.1.1 have been performed to the extent practical. The licensee obtained 8.9 percent of the total weld volume of RPV bottom head meridional welds 1B11-RPV-J31 and 1B11-RPV-J42, which represents coverage of the accessible portions (outside of the RPV vessel support skirt) of these welds. The remaining lengths of these welds are located inside of the RPV support skirt (under the RPV). This area is not accessible for volumetric examinations due to the presence of adjacent CRD housings. The UT examinations were conducted with equipment, procedures and personnel that where qualified by the PDI to the process outlined in ASME Code, Section XI, Appendix VIII. The ASME Code Committees recognized these difficulties when writing the ASME Code requirements and only require that the examination be performed on the accessible length of this particular weld as noted in ASME Code, Section XI, Examination Category

B-A, Item B1.22. Therefore, the NRC staff has determined that the licensee has met the ASME Code requirements and does not require relief for RPV bottom head meridional welds 1B11-RPV-J31 and 1B11-RPV-J42.

RPV Shell-to-Flange Weld 1B11-RPV-F1/1B11-RPV-F2

For RPV shell-to-flange weld sections 1B11-RPV-F1 and 1B11-RPV-F2 the ASME Code requires essentially 100 percent volumetric examination of pressure retaining welds in the RPV. However, the design of the shell-to-flange welds limits complete examinations due to the geometry of the flange-to-shell weld. In order to effectively increase the examination coverage, the RPV and adjacent components would require design modifications or replacement.

In addition, for shell-to-flange weld sections 1B11-RPV-F1 and 1B11-RPV-F2, the outside diameter (OD) transition from the forged ring to the shell plate limited scanning from the upper (ring) side of the welds. The licensee obtained approximately 64 percent of the ASME Code-required volumes using 45- and 60-degree shear waves applied from the OD of the vessel. These welds were examined in the year 2000, prior to ASME Code PDI requirements and prior to development of current technology for examinations from the inside diameter of the vessel. Therefore, the subject examinations were conducted using ASME Code-required technical guidance at that time. No recordable indications were detected during these examinations.

Based on above, the NRC staff has determined, for RPV shell-to-flange weld sections 1B11-RPV-F1 and 1B11-RPV-F2 that the requirements of the ASME Code volumetric examination are impractical, the subject components would need to be redesigned to perform the ASME Code-required examinations, and to impose the ASME Code requirements would place a burden on the licensee. In addition, based on the volumetric coverage obtained and other ASME Code volumetric examinations performed on the RPV shell welds, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected. The NRC staff determined that the ASME Code system leakage tests that were performed during each outage combined with continual monitoring of the RPV system for leakage during operation would provide additional assurance of structural integrity of the subject welds. Therefore,, the NRC staff concluded that the examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.2 Request for Relief RR-42, ASME Code, Section XI, Examination Category B-D, Item B3.90, Full Penetration Welded Nozzles in Vessels, RPV Nozzle-to-Vessel Welds

ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Item B3.90 requires 100 percent volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-7(a) through (d), as applicable, of RPV nozzle-to-vessel 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).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volumes for the RPV nozzle-to-shell welds shown in Table 3.2.1 below.

Table 3.2.1 – ASME Code, Section XI, Examination Category B-D, Item B3.90 Welds		
Weld ID	Weld Type	Coverage Obtained
1B11-RPV-N2F	Reactor Recirculation Inlet Nozzle-to-RPV	57.7%
1B11-RPV-N2G	Reactor Recirculation Inlet Nozzle-to-RPV	57.7%
1B11-RPV-N2H	Reactor Recirculation Inlet Nozzle-to-RPV	57.7%
1B11-RPV-N2J	Reactor Recirculation Inlet Nozzle-to-RPV	57.7%
1B11-RPV-N2K	Reactor Recirculation Inlet Nozzle-to-RPV	57.7%
1B11-RPV-N3A	Main Steam Nozzle-to-RPV	57.6%
1B11-RPV-N3B	Main Steam Nozzle-to-RPV	57.6%
1B11-RPV-N3C	Main Steam Nozzle-to-RPV	57.6%
1B11-RPV-N3D	Main Steam Nozzle-to-RPV	57.6%
1B11-RPV-N6A	RPV Head Spray Nozzle	45.3%
1B11-RPV-N6B	RPV Head Spray Nozzle	45.3%
1B11-RPV-N7	RPV Head Instrument Penetration Nozzle	45.3%
1B11-RPV-N10	RPV Core differential Pressure Instrumentation Nozzle	44.5%
1B11-RPV-N12A	RPV Level Instrumentation Nozzle	44.5%
1B11-RPV-N12B	RPV Level Instrumentation Nozzle	44.5%

Licensee's Basis for Relief Request

The licensee, in its letter dated April 27, 2009, stated that the ASME Code, Section XI, requires volumetric (i.e., UT) examination of nozzle-to-vessel welds from two sides of the weld in order to be 100 percent complete. Due to nozzle configurations of these components, UT examinations are limited to scanning on the shell-side of the nozzle welds. Further, the licensee stated that BSEP, Unit 1 systems and components were designed and fabricated before the examination requirements of the ASME Code, Section XI, were formalized and published. Therefore, the BSEP was not specifically designed to meet the requirements of the ASME Code, Section XI, and full compliance is not feasible or practical within the limits of the current plant design.

The licensee concluded that compliance with the examination coverage requirements of the ASME Code is impractical, because it would require modification, redesign, or replacement of components where geometry prevents 100 percent coverage.

Licensee's Proposed Alternative Examination

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

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric examination of full penetration welded nozzles in the RPV. However, examinations of the subject nozzle welds are limited by the design and OD surface curvature of the nozzles. In order for the licensee to obtain 100 percent of the ASME Code-required examination coverage, the nozzles and/or the RPV would need to be redesigned and modified.

As shown on the sketches and technical descriptions included in the licensee's submittal, examination of the subject nozzles has been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 44.5 percent to 57.7 percent (Table 3.2.1). The 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 RPV shell. This design geometry generally limits ASME Code-required UT angle beam examinations only to the shell side of the nozzle-to-vessel welds.

The subject welds were examined prior to the PDI requirements outlined in the ASME Code, Section XI, Appendix VIII. UT examinations on these carbon steel nozzle welds included 0-degree longitudinal, and 45 and 60-degree shear waves from the shell side. These examinations encompassed most of the weld and base materials near the inside surface of the vessel, which is the area where one would expect service degradation to initiate, if occurring. 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]. Only one recordable indication was detected in the examined areas. This subsurface indication was found on nozzle 1B11-RPV-N3C, and was determined to be acceptable per the ASME Code.

Based on the above, the NRC staff determined that in order for the licensee to perform the ASME Code-required examinations the subject RPV nozzle-to-vessel weld components would have to be redesigned, and to impose the ASME Code requirements would place a burden on the licensee. Therefore, the ASME Code volumetric examination requirements are impractical. The NRC staff further determined that based

[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.

on the volumetric coverage that was obtained on the these subject RPV nozzle-to-vessel 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 welds.

3.3 Request for Relief RR-45, ASME Code, Section XI, Examination Category B-H, Item B8.10, Integral Attachments for Vessels, Reactor Pressure Vessel

ASME Code Requirement

ASME Code, Section XI, Examination Category B-H, Item B8.10 requires essentially 100 percent surface examination, as defined by ASME Code, Section XI, Figure IWB-2500-15, of the length of Class 1 RPV integral attachment 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 15.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection surfaces of integral attachment welds for the following stabilizer lugs on the OD surface of the RPV:

1B11-RPV-LUG45-ATT
1B11-RPV-LUG135-ATT
1B11-RPV-LUG225-ATT, and
1B11-RPV-LUG315-ATT

Licensee's Basis for Relief Request

The licensee in its letter dated April 27, 2009, stated that these lugs, which are integrally welded on the outside diameter of the RPV, are rectangular, welded all around, and with a weld length of approximately 34.5 inches. Each lug rests on the stabilizer ring, causing the bottom of the lug (i.e., approximately 13 inches) to be inaccessible. Examination of the RPV stabilizer lug welds is limited due to the stabilizer ring obstructing the bottom portion of the attachment weld. The licensee further stated that it performed a magnetic particle examination with examination personnel and procedure meeting the requirements of the ASME Code, Section XII and V. The magnetic particle examinations achieved approximately 62 percent coverage on each of the welds. This coverage is the maximum extent practical since access to bottom portion of the attachment weld is not possible. The licensee also stated that due to the close proximity of the stabilizer ring, surface examination is limited to just three sides of the welded attachment.

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 surface examination of the attachment welds on the subject RPV stabilizer lugs. However, surface examinations are limited due to partial inaccessibility caused by their proximity to the RPV stabilizer ring. In order for the licensee to obtain 100 percent of the ASME Code-required examination coverage on these welds, the stabilizer lugs, adjacent bioshield, and RPV insulation would need to be redesigned and modified.

Stabilizer lugs 1B11-RPV-LUG45-ATT, 1B11-RPV-LUG135-ATT, 1B11-RPV-LUG225-ATT, and 1B11-RPV-LUG315-ATT are located on the OD of the RPV. These are rectangular carbon steel plates welded to the RPV that connect to a stabilizer assembly for support of the vessel. Because of their design and location, the stabilizer ring obstructs access to the bottom 13 inches of the total 34.5-inch weld length on each lug, limiting ASME Code-required surface examinations to the welds on the top and sides of the lugs. A magnetic particle examination was performed on the accessible portions of these integral attachment welds with surface coverage of approximately 62 percent for each weld. In addition, a VT-3 visual examination was performed on entire support assembly per ASME Code, Examination Category F-A requirements. No recordable indications were detected associated with the VT-3 examinations.

Based on the above, the NRC staff determined that the ASME Code-required examinations are impractical and to impose the ASME Code requirements would place a burden on the licensee. Furthermore, the NRC staff determined that the licensee has demonstrated that examination of the subject integral attachment welds was performed to the extent practical. Therefore, based on the surface coverage that was obtained on these welds and the VT-3 visual examinations performed on the support assembly, it is reasonable to conclude that if significant service-induced degradation had occurred, 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 welds.

3.4.1 Request for Relief RR-43 (As Revised by Letter Dated February 3, 2010) ASME Code, Section XI, Examination Category B-J, Items B9.11 and B9.31, Pressure Retaining Piping Welds

ASME Code Requirement

ASME Code, Section XI, Examination Category B-J, Items B9.11 and 9.31, require essentially 100 percent volumetric and surface examinations, as defined by ASME Code, Section XI, Figure IWB-2500-8, for piping circumferential welds 4-inch nominal pipe size (NPS) and greater in diameter. "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.

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 (three welds) and surface examination (two welds) 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 Welds

Weld ID	ASME Code Item	Weld Configuration	Weld/Base Material	Coverage Obtained
1B32FFE-12-FWRRA 10A	B9.11	Pipe-to-sweep-o-let	Stainless	50% (volumetric)
1B32RECIRC-22-AM-3BCA	B9.31	Pipe-to-sweep-o-let	Stainless	35% (volumetric)
1B32RECIRC-22-AM-3BCB	B9.31	Pipe-to-sweep-o-let	Stainless	50% (volumetric)
1B214-2-4-FWRFWB6	B9.11	Pipe-to-valve	Carbon	66% (surface)
1B21PS2A3-24-SWJ	B9.11	Pipe-to-elbow	Carbon	50% (surface)

Licensee's Basis for Relief Request

For each of the piping welds shown in Table 3.4.1 above, the examinations have been limited due to OD surface and weld joint configurations. As is indicated by volumetric coverage obtained, most of the welds are only examined from a single side due to these conditions.

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 and surface examination of selected ASME Code, Section XI, Examination Category B-J pressure retaining welds in piping. However, complete examinations are restricted by several factors, including weld configurations and adjacent support components. These conditions preclude the licensee from obtaining full volumetric and surface examinations of these welds. To gain access for examination, the welds and adjacent items would require design modifications.

For the three welds with limited volumetric coverage, examinations of the subject welds have been performed to the extent practical with the licensee obtaining volumetric coverage ranging from 35 to 50 percent from at least one side for the welds. Volumetric

scan limitations were caused by the pipe-to-sweep-o-let configuration of the welds. UT personnel, procedures, and equipment qualified through the industry's PDI were employed, including 45-, 60-, and 70-degree (as applicable) shear wave and refracted longitudinal wave (L-wave) techniques from the accessible sides of these welds. The combined shear and L-wave examinations account for the aggregate coverage reported. Although the licensee did not claim credit for coverage on the inaccessible side of these 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[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. The licensee completed the ASME Code-required surface examinations on the subject welds with no limitations. No recordable indications were observed during the UT and surface examinations.

For the two welds with limited surface coverage, magnetic particle (MT) examinations have been performed to the extent practical with coverage of 50 percent and 66 percent for these welds (Table 3.4.1 above). However, as discussed in the licensee's November 20, 2009, response to NRC's RAI, full volumetric examinations were completed on the two welds. The surface examinations were restricted by adjacent component supports and floor grating. These conditions allow UT transducer placement for full coverage manual volumetric examinations, but do not provide adequate space for MT equipment to be placed, or for surface preparation methods needed prior to applying a liquid penetrant (PT) technique. No recordable indications were detected during the UT or MT examinations of these welds.

Based on the above information, the NRC staff determined that the ASME Code-required volumetric and surface examinations are impractical for the subject welds and to impose the ASME Code requirements would place a burden on the licensee. The NRC staff determined that, based on the coverage obtained and considering the full examination of other pressure retaining piping welds, it is reasonable to conclude that, if significant service-induced degradation had occurred, 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 welds.

3.4.2 Request for Relief RR-43 (As Revised by Letter Dated February 3, 2010) ASME Code, Examination Category R-A, Item R1.20, Pressure Retaining Piping Welds

ASME Code Requirement

The examination requirements for the subject piping welds at BSEP-1 are governed by a risk-informed inservice inspection (RI-ISI) program that was approved by the NRC in a letter dated November 28, 2001. The RI-ISI program was developed in accordance with the EPRI topical report, TR-112657, Rev. B-A, "Revised Risk-Informed Inservice

[2] 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.

[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, ASME.

Inspection Evaluation Procedure." As part of the NRC-approved program, the licensee has implemented inspection requirements listed in ASME Code Case N-578-1[4], "Risk-Informed Requirements for Class 1, 2 or 3 Piping, Method B," with more detailed provisions contained in TR-112657, Rev. B-A. 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-578-1 assigns the Examination Category R-A, Item R1.20, to piping inspection elements not subject to a known damage mechanism. This table requires 100 percent of the examination location volume, as described in ASME Code, Section XI, Figures IWB-2500-8, -9, -10, or -11, as applicable, including an additional ½-inch of base metal adjacent to the ASME Code volume, be completed for selected Class 1 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).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volume for Class 1 piping welds shown in Table 3.4.2 below.

Table 3.4.2 – ASME Code, Section XI, Examination Category R-A, Item R1-20

Weld ID	Weld Type	Weld/Base Material	Coverage Obtained
1B32RECIRC-28-A-9BC-1	Pipe-to-Weld-o-let	Stainless	50.0%
1B32RECIRC-28-A-15BC-1	Pipe-to-Weld-o-let	Stainless	42.7%
1B32RECIRC-28-A-12BC	Pipe-to-Weld-o-let	Stainless	41.3%
1B32RECIRC-28-B-12BC	Pipe-to-Weld-o-let	Stainless	50.0%
1B32RECIRC-28-B-9BC	Pipe-to-Weld-o-let	Stainless	50.0%
1G31PC1-1-FWRWCUC1A	Nozzle-to-Pipe	Stainless	50.0%
1E21FF-8-FW1CS30	Elbow-to-elbow	Carbon	84.4%

Licensee's Basis for Relief Request

The licensee stated the volumetric examinations for the welds, listed in Table 3.4.2 above, were either limited to a single-sided examination due to configuration or limited due to structural interferences of surrounding components.

[4] ASME Code Case N-578-1 has not been approved for use in RG-1.147, Revision 15. Licensees base their RI-ISI inspection sample size and examination methodology on Table 1 of ASME Code Case N-578-1.

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 BSEP-1 are governed by an RI-ISI program that was approved by the NRC in a letter dated November 28, 2001. This program assigns Examination Category R-A, Item R1.20 to piping elements not subject to a known damage mechanism, and requires inspection of 100 percent of the examination location volume for Class 1 circumferential piping welds. However, the subject piping weld configurations and interfering structural components limit volumetric examinations. In order to meet the RI-ISI program volumetric coverage requirements, these components would have to be redesigned and modified.

As shown on the sketches and technical descriptions included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical with aggregate volumetric coverage ranging from approximately 41 percent to 84 percent of the ASME Code-required volumes. The limitations encountered during the performance of the UT examinations were caused by elbow-to-elbow, pipe-to-weld-o-let, or nozzle-to-pipe configurations (Table 3.4.2). These configurations limit volumetric examinations to only a single side of the weld. UT personnel, procedures and equipment qualified through the industry's PDI were employed, including 45-, 60-, and 70-degree (as applicable) shear wave and refracted L-wave techniques from the accessible sides of these welds. The L-wave method is capable of detecting planar ID surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[5,6] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. No recordable flaw indications were observed during the UT examinations.

Based on the above, the NRC staff determined that the ASME Code-required 100 percent volumetric examination is impractical for the subject welds and to impose the ASME Code requirements would place a burden on the licensee. Although the ASME Code-required coverage could not be obtained, the UT methods 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 examinations that were

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5 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.

6 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.

performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject welds.

4.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittal and concluded that ASME Code examination coverage requirements are impractical for the subject welds listed in RR-42, revised RR-43, RR-44 (ASME Code Examination Category B-A, Item B1.30), and RR-45. The NRC staff also concluded that imposition of these ASME Code requirements would create a burden on the licensee. The NRC staff further has determined that based on the volumetric and surface coverage, if applicable, 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. Therefore, the NRC staff concluded that the examinations were performed to the extent practical and would provide reasonable assurance of structural integrity of the subject welds.

Accordingly, the NRC staff has determined that granting RR-42, revised RR-43, RR-44 (ASME Code Examination Category B-A, Item B1.30), and RR-45 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. Therefore pursuant to 10 CFR 50.55a(g)(6)(i), the NRC grants relief for the requests RR-42, revised RR-43, RR-44 (ASME Code Examination Category B-A, Item B1.30), and RR-45 for the third 10-year ISI interval at BSEP-1. For request RR-44 (ASME Code, Examination Category B-A, Item B1.22), the NRC staff concludes that the licensee has met the ASME Code requirements and does not require relief for meridional head welds 1B11-RPV-J31 and 1B11-RPV-J42.

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 and Carol Nove

Date: April 30, 2010

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**
RR-44	3.1	Pressure Retaining Welds in Reactor Vessel	B-A	B1.22 B1.30	100% of Class 1 RPV shell and head meridional welds	Volumetric	Use volumetric coverage achieved	For Item B1.22 Relief Is Not Required. For Item B1.30 Relief Is Granted 10 CFR 50.55a(g)(6)(i)
RR-42	3.2	Full Penetration Welded Nozzles in Reactor Vessel	B-D	B3.90	100% of Class 1 RPV nozzle to vessel welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
RR-45	3.3	Integral Attachments for Reactor Vessel	B-H	B8.10	100% of Class 1 welded integral attachments on RPV	Surface	Use surface coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
Revised RR-43,	3.4.1	Class 1 Piping Welds	B-J	B9.11 B9.31	100% of selected Class 1 piping welds	Surface and Volumetric	Use surface and volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
Revised RR-43,	3.4.2	Class 1 Piping Welds – RI-ISI program	R-A	R1.20	100% of selected Class 1 piping welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)

Attachment

The NRC staff's safety evaluation is enclosed. If you have any questions regarding this matter, please contact Farideh Saba at (301) 415-1447.

Sincerely,

/RA/

Douglas A. Broaddus, Acting Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-325

Enclosure: Safety Evaluation

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