



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

January 7, 2011

Mr. David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION, UNIT NO. 1, THIRD 10-YEAR INSERVICE INSPECTION INTERVAL PROGRAM, RELIEF REQUEST N1-I3-PRT-004, PART A THROUGH PART G (TAC NOS. ME3333, ME5136, ME5137, ME5138, ME5139, ME5140 AND ME5141).

Dear Mr. Heacock:

By letter to the U.S. Nuclear Regulatory Commission (NRC), dated February 1, 2010, as supplemented by letters dated August 30, 2010, Virginia Electric and Power Company (the licensee) submitted relief requests for Alternatives N1-I3-PRT-004 based, in part, on the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Class 1, 2, and 3, Section XI, at North Anna Power Station Unit No. 1. Specifically, the licensee requested relief from certain examination coverage requirements for selected components for the third 10-year inservice inspection (ISI) interval, which began in May 1999, and ended in April 2009.

The NRC staff has completed its review as documented in the enclosed safety evaluation. Based on a review of the information provided in your application, 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 third 10-year ISI interval. 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.

D. Heacock

- 2 -

If you have any questions concerning this matter, please contact Dr. Sreenivas, at (301) 415-2597.

Sincerely,

A handwritten signature in cursive script, appearing to read "Patricia L. Boyle".

Gloria Kulesa, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-338

Enclosure:
Safety Evaluation

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

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF REQUEST NO. N1-I3-PRT-004

NORTH ANNA POWER STATION, UNIT NO. 1

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-338

1.0 INTRODUCTION

By letter dated February 1, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML100321205), and supplemented by letter dated August 30, 2010 (ADAMS Accession No. ML102460048), Virginia Electric and Power Company (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 North Anna Power Station (NAPS), Unit 1, for selected components. Relief Requests (RRs) N1-I3-PRT-004 for the third 10-year ISI interval.

The U.S. Nuclear Regulatory Commission (NRC, the Commission) 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 which has been incorporated into this safety evaluation (SE). The Attachment to this SE lists each relief request and the status of approval.

1.0 REGULATORY REQUIREMENTS

The ISI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (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

Enclosure

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 NAPS-1 third 10-year interval ISI program, which ended on April 30, 2009, is the 1989 Edition, with no Addenda, of Section XI of the ASME Boiler and Pressure Vessel Code as approved by the NRC.

2.0 EVALUATION

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

2.1 Request for Relief N1-13-PRT-004, Part A, ASME code, Section XI, Examination Category B-A, Items B1.11, B1.21, and B1.22, Pressure Retaining Welds in Reactor Pressure Vessel

ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Items B1.11, B1.21, and B1.22, require essentially 100% volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-1 and -3, as applicable, of the length of reactor pressure vessel (RPV) circumferential shell and head welds, and RPV meridional head welds. "Essentially 100%", as clarified by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," is greater than 90% coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in Regulatory Guide 1.147, Revision 15, (RG 1.147, R15) "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 the ASME Code-required volumetric examination of ASME Code, Class 1 RPV circumferential and meridional welds listed in Table 3.1.1 below.

ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B1.11	W04	Lower Shell-to-Bottom Head Spherical Ring Weld	76.0%
B1.21	W08	Bottom Head Spherical Ring-to-Bottom Head Cap Weld	75.0%
B1.22	W06	Meridional Weld at 192.5 Degrees	61.0%
B1.22	W07	Meridional Weld at 72.5 Degrees	67.0%

Licensee's Basis for Relief Request (as stated)

Ultrasonic [(UT)] examination of [Shell-to-Bottom Head Spherical Ring W04] is limited to 76% coverage due to the core support pads at four locations along the path of the weld.

[UT] examination of [Bottom Head Spherical Ring-to-Bottom Head Cap Weld W08] is limited to 75% coverage due to the incore instrumentation nozzles along the path of the weld.

[UT] examination of [Meridional Weld at 192.5 Degrees W06] is limited to 61% coverage and [Meridional Weld at 72.5 Degrees W07] is limited to 67% coverage due to the incore instrumentation nozzles and core lug obstructions.

Destruction of the component would be necessary to perform 100% of the [ASME Code-required] examination as written in the [1989 Edition of the ASME Code] and is contrary to the intent of the [ASME] Code.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

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

As shown in the sketches and technical descriptions included in the licensee's submittals, examinations of the subject RPV circumferential shell and head welds and meridional head welds have been performed to the extent practical, with the licensee obtaining coverage of approximately 61.0% to 76.0% (see Table 3.1.1 above). Lower Shell-to-Bottom Head Spherical Ring Weld W04 was restricted by four core support pads located at 0-, 90-, 180-, and 270-degrees inside the RPV. Bottom Head Spherical Ring-to-Bottom Head Cap Weld W08 could only be scanned from a limited number of areas due to the sixteen instrumentation nozzles (numbers 35-50) on the inside of the bottom head. For Meridional Head Welds W06 and W07, scan restrictions were caused by the incore instrumentation nozzles and core lugs located at 180- and 90-degrees, respectively. The UT examinations included a 45-degree shear wave and a 45- and 70-degree refracted longitudinal wave scans. All of the examinations were conducted with equipment, procedures and personnel that were qualified by performance demonstration in accordance with ASME Code, Section XI, Appendix VIII. During these examinations, one subsurface flaw in W04 and 17 subsurface flaws in W08 were detected and evaluated as being acceptable by the criteria of ASME Code, Section XI, Paragraph IWB-3510-1.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject RPV welds due to their geometrical design and proximity of

permanent adjacent appurtenances. Based on the volumetric coverage obtained, in addition to the full examination of other pressure retaining RPV 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.

2.2 Request for Relief N1-13-PRT-004, Part B, ASME Code, Section XI, Examination Category B-D, Item B3.110, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Item B3.110, requires 100% volumetric examination, as defined by ASME Code, Section XI, Figure IWB-2500-7 (a) through (d), as applicable, of full penetration Class 1 pressurizer (PZR) nozzle-to-vessel welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R15, 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% of examination coverage, i.e., greater than 90% examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examinations for the PZR nozzle-to-vessel welds listed in Table 3.2.1 below.

Table 3.2.1 ASME Code, Section XI, Examination Category B-D			
ASME Code Item	Weld ID	Weld Type	Coverage Obtained
B3.110	1-RC-E-2/10	Pressurizer Safety Nozzle-to-Vessel Weld	78.4%
B3.110	1-RC-E-2/11	Pressurizer Safety Nozzle-to-Vessel Weld	78.4%
B3.110	1-RC-E-2/12	Pressurizer Safety Nozzle-to-Vessel Weld	78.4%
B3.110	1-RC-E-2/13	Pressurizer Relief Nozzle-to-Vessel Weld	51.2%
B3.110	1-RC-E-2/14	Pressurizer Spray Nozzle-to-Vessel Weld	75.0%

Licensee's Basis for Relief Request (as stated)

[UT] examination of the following pressurizer nozzle-to-vessel welds [listed in Table 3.2.1 above] are limited in coverage due to the pressurizer to nozzle weld configuration. Examination was performed to the extent possible using qualified equipment, and no further coverage is possible with existing technology. Destruction of the component would be necessary to perform 100% of the [ASME Code-required] examination as written in the 1989 Edition of the [ASME Code, Section XI] and is contrary to the intent of the [ASME] Code.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The ASME Code requires 100% volumetric examination of ASME Code, Class 1, PZR nozzle-to-vessel welds. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining welds. However, the design configurations of the subject nozzle-to-vessel welds limit access for UT scanning primarily to the vessel side of the welds. In order to effectively increase the examination coverage, the nozzle-to-head welds would require design modifications or replacement. This would place a burden on the licensee; thus, the ASME Code volumetric examination requirements are considered to be impractical.

The subject PZR nozzle-to-vessel welds shown in Table 3.2.1 above are constructed of SA-508 Class 2 carbon steel material, with austenitic stainless steel inside diameter cladding. The welds extend the full thickness of the PZR vessel. 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 PZR vessel. This design geometry limits ASME Code-required UT angle beam examinations to be performed primarily from the vessel side of the welds.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject nozzle-to-vessel welds have been completed to the extent practical with aggregate coverage of the ASME Code-required volumes as listed in Table 3.2.1 above. UT examinations were conducted using ASME Code, Section V, Article 4, techniques and included 0-degree longitudinal, and 45- and 60-degree shear waves from the vessel side. The examination volumes included the weld and base materials near the inside surface of the weld joint, which are typically the highest regions of stress, and where one would expect degradation sources to be manifested should they occur. No unacceptable indications were recorded during these examinations. Although UT scans were primarily limited to the vessel 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 weldment¹. 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 it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject PZR nozzle-to-vessel welds due to the nozzle designs. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of UT techniques employed to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject welds.

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.

2.3 Request for Relief N1-13-PRT-004, Part C, ASME Code, Section XI, Examination Category B-K, Item B10.20, Integral Attachments for Class 1 Vessels, Piping, Pumps, and Valves

ASME Code Requirement

ASME Code, Section XI, Examination Category B-K, Item B10.20, requires essentially 100% surface examination, as defined by ASME Code, Section XI, Figures IWB-2500-13, -14, and -15, as applicable, of selected integrally welded attachments to ASME Code, Class 1 piping. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, R15.

Note: During the third 10-year ISI interval, the licensee invoked ASME Code Case N-509, "Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments," which replaces ASME Code, Section XI, Category B-H, Integral Attachments for Vessels, and Category B-K-1, Integral Attachments for Piping, Pumps, and Valves, in ASME Code, Section XI, Table IWB 2500-1, with Category B-K, Integral Attachments for ASME Code, Class 1 Vessels, Piping, Pumps and Valves as listed in ASME Code Case N-509, Table 2500-1. ASME Code Case N-509 has been approved for use by the NRC in RG 1.147, R15, subject to the following condition in addition to those conditions specified in the ASME Code Case N-509: A minimum 10% sample of integrally welded attachments for each item in each code class per interval should be examined. NAPS-1 has met this condition and, therefore, the subject request for relief has been evaluated using ASME Code Case N-509, Category B-K, as a basis for technical requirements.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required surface examination of Pipe Support Integral Attachment Weld 18H for support RH-1 on the 6" Low Head Safety Injection Line to B Reactor Coolant System (RCS) Cold Leg.

Licensee's Basis for Relief Request (as stated)

Surface examination of the integral attachment weld for support RH-1 on 6" Low Head Safety Injection line to B RCS Cold Leg is limited to 87.27% coverage due to inaccessible areas missed because of an adjacent pipe clamp. All similar lugs have the same limitations. Examination was performed to the extent possible.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The ASME Code requires essentially 100% surface examination of ASME Code, Class 1, piping integral attachment welds. However, surface examination for the subject weld is limited due to the piping support design. In order for the licensee to obtain 100% of the ASME Code-required surface examination coverage, the integral attachment weld would have to be redesigned and

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

As shown on the sketch and technical descriptions included in the licensee's submittals, the liquid penetrant test (PT) surface examination of Pipe Support Integral Attachment Weld 18H has been performed to the extent practical, with the licensee obtaining significant coverage of the ASME Code-required surface area (87.3%). The inspection of the box type piping support is limited due to the pipe clamp adjacent to the bottom portion, areas of the piping attachment. No unacceptable indications were detected during the surface examination.

The licensee has shown that it is impractical to meet the ASME Code-required surface examination coverage for the subject ASME Code, Class 1, piping integral attachment weld. However, based on the level of surface coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject welds.

2.4 Request for Relief N1-13-PRT-004, Part D, ASME Code, Section XI, Examination Category R-A, Item R1.11, Risk-Informed Piping Examinations

ASME Code Requirement

The examination requirements for the subject piping welds at NAPS-1 are governed by a Risk-Informed Inservice Inspection (RI-ISI) program that was approved by the NRC in a SE dated September 18, 2001 (ADAMS Accession No. ML012470437). The RI-ISI program was developed in accordance with the Westinghouse Owners Group Topical Report WCAP-14572, "*Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report, Revision 1-NP-A.*" As part of the NRC-approved program, the licensee has implemented inspection requirements listed in ASME Code Case N-577², "*Risk-Informed Requirements for Class 1, 2 or 3 Piping, Method A,*" with more detailed provisions contained in WCAP-14572. The topical report includes a provision for requesting relief from volumetric examinations if 100% of the required volumes cannot be examined.

Table 1 of ASME Code Case N-577 assigns the Examination Category R-A, Item R1.11, to piping inspection elements subject to a thermal fatigue damage mechanism. This table requires 100% of the examination location volume, as described in ASME Code, Figures IWB-2500-8(c), 9, 10, or 11, as applicable, including an additional ½-inch of base metal adjacent to the ASME Code volume, be completed for selected ASME Code, Class 1, circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R15, 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% of the examination volume, i.e., greater than 90% examination coverage is obtained.

2 ASME Code Case N-577 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-577.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage of the piping welds shown in Table 3.4.1 below.

Table 3.4.1 – ASME Code, Section XI, Examination Category R-A, Item R1.11		
Weld ID	Weld Configuration	Coverage Obtained
6-RC-21/18	Elbow-to-Weld-o-let	83.3%
6-RC-20/41	Valve-to-Elbow	50.0%
6-RC-20/42	Pipe-to-Coupling	83.4%
14-RC-10/SW-5 1	Safe End-to-Nozzle	65.0%
27 ½-RC-3/10	Pipe-to-Valve	39.0%
27 ½-RC-3/SW-41	Branch Pipe Connection	35.0%
27 ½-RC-6/38	Pump-to-Pipe	75.0%
27 ½-RC-9/34	Pipe-to-Valve	8.3%
27 ½-RC-9/SW-43	Nozzle-to-Cold Leg	22.0%
3-CH-1/19	Valve-to-Elbow	50.0%
6-SI-131/21	Tee-to-Valve	48.0%

Note: In the licensee's response dated August 30, 2010 to the NRC RAI, NAPS-1 withdrew request for relief, N1-13-PRT-004, Examination Category R-A, Item R1.11, for volumetric examination of the dissimilar metal welds 29-RC-4/N-SE29 IN, 31-RC-5/N-SE31 IN., and 31-RC-8/N-SE31 IN. The licensee re-examined these welds during N1-R20 (2009 refueling outage) using an ASME Code, Section XI, Appendix VIII-qualified phased array technique and obtained 100% coverage for each of these welds.

Licensee's Basis for Relief Request (as stated)

Relief is requested from the "essentially 100 percent" volumetric examination coverage requirement for the identified piping welds [listed in Table 3.4.1 above]. This requirement is considered impractical primarily due to single-sided access for these components.

The purpose of nondestructive examination (NDE) is to perform inspections without destroying the component. Any [destructive] actions necessary to make these welds accessible for NDE exam would be contrary to the intent of the ASME Code. Design modification would be necessary to provide sufficient access, and imposition of this requirement would cause a considerable burden.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The examination requirements for the subject piping welds are governed by a RI-ISI program that was approved by the NRC in a SE dated September 18, 2001. This program requires that selected piping welds be volumetrically examined in accordance with the requirements of ASME Code Case N-577. However, the design configuration of these welds limit the coverage for volumetric examinations. In order to increase coverage, the welds would have to be re-designed and modified, therefore, the ASME Code Case-required volumetric examination coverage are considered impractical.

As shown in the technical descriptions and sketches provided in the licensee's submittals, examinations of the subject welds have been performed to the extent practical, with the licensee obtaining volumetric coverage ranging from 8.3 to 83.4% (see Table 3.4.1 above) of the required volumes from at least one side of the welds. The design of these piping welds prevents full volumetric scanning due to tapers, radii, and materials of the pipe-to-valve, pipe-to-coupling, valve-to-elbow, elbow-to-weld-o-let, pump-to-pipe, safe end-to-nozzle, tee-to-valve, nozzle-to-cold leg, and branch pipe connection weld configurations. When possible, the licensee selected additional welds to be scanned from the same risk-informed segments and were able to obtain full ASME Code volumetric coverage.

All of the examinations were conducted with equipment, procedures, and personnel that were qualified by performance demonstration in accordance with ASME Code, Section XI, Appendix VIII. These techniques have been qualified for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." For this reason, the licensee has not taken credit for any of the far-side detection efforts in the volumetric coverage listed in Table 3.4.1 above. The licensee performed 45-, 60-, and 70-degree shear waves, and 45- and 60-degree refracted longitudinal wave (L-waves) to most of these welds. The L-wave techniques have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds.^{3,4} While the licensee has only taken credit for obtaining volumetric coverage for one side of the subject piping welds, the techniques employed would have provided coverage beyond the near-side of the welds. The UT examinations did not reveal any unacceptable flaws.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the design geometry of the welds and materials of construction. Based on the UT results and coverage obtained, in addition to the full examination coverage of other piping welds in the same risk category and pipe segments, it is reasonable to conclude that, if significant service-induced degradation had occurred in the subject piping segments, evidence of it would have been detected by the examinations performed.

3 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.

4 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.

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

2.5 Request for Relief N1-13-PRT-004, Part E, ASME Code, Section XI, Examination Category C-B, Item C2.21, Pressure Retaining Nozzle Welds in Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category C-B, Item C2.21, requires 100% volumetric and surface examination, as defined by ASME Code, Section XI, 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, R15, 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% of the examination coverage, i.e., greater than 90% examination coverage is obtained.

Licensee ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of Boron Injection Tank (BIT) Nozzle-to-Shell Welds 1-SI-TK-2/3 (Weld 3) and 1-SI-TK-2/4 (Weld 4).

Licensee's Basis for Relief Request (as stated)

UT examination of the identified nozzle to vessel welds on the [BIT] is limited to 36% volume coverage because of single sided access due to nozzle to shell weld configuration. Examiners were unable to obtain any coverage with the 0 degree scans. Examination was performed to the extent possible. Destruction of the component would be necessary to perform 100% of the [ASME] Code required examination as written in the [1989 Edition of the ASME Code, Section XI] and is contrary to the intent of the [ASME] Code.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The ASME Code requires 100% volumetric and surface examinations of ASME Code, Class 2, nozzle-to-shell (or head) welds. However, for BIT nozzle-to-shell welds complete examination is limited due to the nozzle configuration. 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, with stainless steel cladding, BIT Nozzle-to-Shell Welds 3 and Weld 4 were performed to the extent practical, with the licensee obtaining 36% 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 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.

Manual UT examinations were performed in accordance with the requirements of the ASME Code, Section V, Article 4. The licensee also completed the full ASME Code required surface examinations (magnetic particle) on both of these welds. No unacceptable indications were noted during the volumetric and surface 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 weldment⁵. 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 it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject nozzle-to-shell welds due to the nozzle design configuration. However, based on the volumetric and full 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 performed. Furthermore, the NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject welds.

2.6 Request for Relief N1-13-PRT-004, Part F, ASME Code, Section XI, Examination Category C-C, Item C3.20, Integral Attachments for ASME Code, Class 2 Vessels, Piping, Pumps, and Valves

ASME Code Requirement

ASME Code, Section XI, Examination Category C-C, Item C3.20, requires 100% surface examination, as defined by ASME Code, Section XI, Figure IWC-2500-5, of integrally welded attachments to ASME Code, Class 2, piping. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R15, 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% of the examination coverage, i.e., greater than 90% examination coverage is obtained.

Note: During the third 10-year ISI interval, the licensee invoked ASME Code Case N-509, which replaces Category C-C, Integral Attachments for Vessels, Piping, Pumps, and Valves in ASME Code, Section XI, Table IWC 2500-1 with Category C-C, Integral Attachments for ASME Code, Class 2 Vessels, Piping, Pumps, and Valves in ASME Code Case N-509, Table 2500-1. ASME Code Case N-509 has been approved for use by the NRC in RG 1.147, R15, subject to the following condition in addition to those conditions specified in the ASME Code Case N-509: A minimum 10% sample of integrally welded attachments for each item in each code class per interval should be examined. NAPS-1 has met this condition and therefore, the subject request for relief has been evaluated using ASME Code Case N-509, Category C-C as a basis for technical requirements.

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

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% surface examination of the integrally welded attachments for ASME Code, Class 2 piping listed in Table 3.6.1 below.

ASME Code Item	Weld ID	Weld Type	Coverage Obtained
C3.20	6-SI-19/26H	6" Low Head Safety Injection Line to B Reactor Coolant System Hot Leg	85.4%
C3.20	8-QS-4/34H	8" Discharge piping from B Quench Spray Pump	84.9%

Licensee's Basis for Relief Request (as stated)

Surface examination of the integral attachment weld on the 6" Low Head Safety Injection line to B RCS Hot Leg Inside Containment is limited to 85.43% coverage due to inaccessible areas missed because of an adjacent pipe clamp. Surface examination of the integral attachment weld for Support R-72 on the 8" discharge piping from B Quench Spray Pump (1-QS-P-1B) is limited to 84.85% coverage due to inaccessible areas missed because of an adjacent pipe clamp. All similar lugs have the same limitations. Examination was performed to the extent possible.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The ASME Code requires 100% surface examination of the subject ASME Code, Class 2, integral piping attachment welds. However, surface examinations are limited due to partial inaccessibility caused by the piping support design. In order for the licensee to obtain 100% of the ASME Code-required examination coverage, the integral attachment welds would have to be redesigned and modified. This would place a burden on the licensee; therefore, the ASME Code examination requirements are considered impractical.

As shown on the sketch and technical descriptions included in the licensee's submittals, PT examinations of the subject integral piping attachment welds have been performed to the extent practical, with the licensee obtaining significant surface examination coverage of approximately 84.9% for the 8" stainless steel discharge piping from B Quench Spray Pump and 85.4% for the 6" Stainless Steel Low Head Safety Injection Line to B RCS Hot Leg. Interferences to the surface examinations on the subject integral attachment welds were caused by adjacent pipe supports. No unacceptable indications were detected during these surface examinations.

The licensee has shown that it is impractical to meet the ASME Code-required surface examination coverage for the subject ASME Code, Class 2, integral piping attachment welds. However, based on

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

2.7 Request for Relief N1-13-PRT-004, Part G, ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping

ASME Code Requirement

ASME Code, Examination Category C-F-1, Items C5.11 and C5.21, require 100% volumetric and surface examinations, as defined by ASME Code, Figure IWC-2500-7, of selected ASME Code, Class 2, austenitic stainless steel or high alloy circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R15, 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% of the examination coverage, i.e., greater than 90% examination coverage is obtained.

Licensee ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examinations 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	Coverage Obtained
C5.11	10-SI-141/4	Tee-to-Valve	50.0%
C5.11	10-SI-141/5	Valve-to-Pipe	50.0%
C5.11	6-CH-19/SW-20W	Flange-to-Pipe	50.0%
C5.11	6-CH-19/1	Valve-to-Pipe	50.0%
C5.11	6-SI-169/SW-39	BIT Nozzle-to-D/S Elbow	65.4%
C5.11	14-RH-2/11	Valve-to-Pipe	50.0%
C5.21	3-CH-11/SW-1W	Tee-to-Pipe	50.0%
C5.21	3-SI-23/SW-65	Elbow-to-Pipe	84.1%

Licensee's Basis for Relief Request (as stated)

UT examination of the identified piping welds are limited as identified in the [in Table 3.7.1 above] primarily due to single-sided access. Examination was performed to the extent possible. The purpose of [NDE] is to perform inspections without destroying the component. Any actions necessary to make these welds accessible for NDE exam would be contrary to the intent of the [ASME,] Code.

Licensee's Proposed Alternative Examination

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

Staff Evaluation

The ASME Code requires 100% volumetric and surface examination coverage of selected ASME Code, Class 2, 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, materials, and adjacent components. To gain access for examination, the welds and adjacent components would require design modifications. Imposition of this requirement would create a burden on the licensee; therefore, the ASME Code-required 100% 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 50 to 84.1%. Access for examination of the subject piping welds is limited to the one side of the weld due to the surface angle caused by the tee-to-valve, valve-to-pipe, elbow-to-pipe, nozzle-to-elbow, flange-to-pipe, or tee-to-pipe weld configurations (see Table 3.7.1 above). For Weld SW-65, volumetric examination was also limited due to the proximity of a downstream drain line. The UT techniques employed for all of these stainless steel welds have been qualified through the industry's Performance Demonstration Initiative (PDI), which meets ASME Code, Section XI, Appendix VIII requirements and 10 CFR 50.55a(e)(2)(xv).

The licensee's UT techniques for most of the welds listed in Table 3.7.1 above included 45-, 60-, and 70-degree shear waves, as applicable. For Weld SW-39, in addition to the 40- and 45-degree shear wave scans, the UT techniques included 45- and 60- degree refracted L-waves, which have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds^{6,7}. While the licensee has only taken credit for obtaining 65.4% volumetric coverage for the subject piping weld, 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. No unacceptable indications were detected during the volumetric examinations. The licensee also completed full ASME Code surface examinations (PT) on Welds SW-39 and SW-65 which have been identified as being susceptible to outside surface corrosion attack. One indication was found on SW-39 which was removed by excavation and was considered acceptable upon removal.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject piping welds due to their geometric configuration, materials and adjacent components. Based on the volumetric coverage obtained, and considering the full examination of other similar piping welds, it is reasonable to conclude that, if significant

-
- 6 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.
- 7 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.

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.

3.0 CONCLUSIONS

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 RR N1-13-PRT-004. Furthermore, imposition of these ASME Code requirements would create a burden on the licensee. The NRC staff further 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. 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 their next scheduled inspections for the components contained in RR N1-13-PRT-004, Parts D and G. Furthermore, the NRC staff concluded that 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 RR N1-13-PRT-004 for NAPS-1. The NRC staff has further determined that granting this request for relief 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.

Principal Contributors: T. McLellan
D. Naujock

Date: January 7, 2011

Attachment

**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
N1-13-PRT-004, Part A	3.1	Pressure Retaining Welds in Reactor Vessel	B-A	B1.11 B1.21 B1.22	100% of Class 1 RPV circumferential shell and head welds, and meridional head welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part B	3.2	Full Penetration Welded Nozzles in Vessels	B-D	B3.110	100% of Class 1 PZR nozzle-to-vessel welds	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part C	3.3	Integral Attachments for Class 1 Vessels, Piping, Pumps, and Valves	B-K	B10.20	100% of Class 1 Integrally Welded Attachment for Piping	Surface	Use surface coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part D	3.4	Risk-Informed Piping	R-A	R1.11	100% of Class 1 piping subject to a thermal fatigue damage mechanism	Volumetric	Use volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part E	3.5	Pressure Retaining Nozzle Welds in Vessels	C-B	C2.21	100% of Class 2 nozzle-to-shell (or head) welds	Volumetric and Surface	Use volumetric and surface coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part F	3.6	Integral attachments for Class 2 Vessels, Piping, Pumps, and Valves	C-C	C3.20	100% of Class 2 Integrally Welded Attachments for Piping	Surface	Use surface coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
N1-13-PRT-004, Part G	3.7	Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping	C-F-1	C5.11 C5.21	100% of Class 2 austenitic stainless steel or high alloy circumferential piping welds	Volumetric and Surface (as applicable)	Use volumetric and surface (as applicable) coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)

D. Heacock

- 2 -

If you have any questions concerning this matter, please contact Dr. Sreenivas, at (301) 415-2597.

Sincerely,

/RA by PBoyle Acting for/

Gloria Kulesa, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-338

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

DISTRIBUTION:

Public
LPL2-1 R/F
RidsNrrDorLpl2-1 Resource
RidsNrrLAMO'Brien Resource
RidsNrrPMNorthAnna Resource
TLupold, NRR
MMitchell, NRR
NSanfilippo, EDO

RidsAcrsAcnw_MailCTR Resource
RidsRgn2MailCenter Resource
RidsOgcRp Resource
RidsNrrDciCpnb Resource
RidsNrrDciCvib Resource
DNaujock, NRR
TMcLellan, NRR

ADAMS Accession No.: ML110060011

* by memo dated 11/09/2010 and 11/03/2010

OFFICE	NRR/LPL2-1/PM	NRR/LPD2-1/LA	NRR/CVIB/BC	NRR/CPNB/BC	NRR/LPL2-1/BC
NAME	VSreenivas	MO'Brien (SRohrer for)	MMitchell*	TLupold*	GKulesa (PBoyle for)
DATE	1/6/11	1/6/11	11/09/2010	11/03/2010	1/7/11

OFFICIAL RECORD COPY