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

August 30, 2013

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 - RELIEF REQUEST (RR) N1-I4-LMT-001, LIMITED EXAMINATIONS FOR THE FOURTH TEN-YEAR INSPECTION INTERVAL PERIOD 1 (TAC NO. ME9913)

Dear Mr. Heacock:

By letter dated November 1, 2012, Agencywide Documents Access and Management System (ADAMS) Accession No. ML12319A278), Virginia Electric and Power Company (the licensee) submitted a relief request (RR) N1-I4-LMT-001 requesting relief from a certain requirement of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, related to essentially 100 percent coverage of examination volume or surface area. RR N1-I4-LMT-001 is applicable for the fourth 10-year inservice inspection (ISI) interval at the North Anna Power Station (North Anna), Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief and to use alternative requirements (if necessary), for ISI items identified in RR N1-I4-LMT-001 on the basis that the Code requirement is impractical.

Based on the review of the information, the U.S. Nuclear Regulatory Commission (NRC) concludes that the licensee's proposed alternative in accordance with 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. Therefore, the NRC staff grants RR N1-I4-LMT-001 at North Anna, Unit 1, for the fourth 10-year ISI interval which commenced on May 1, 2009, and will end on April 30, 2019,.for the fourth 10-year ISI interval.

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

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

Sincerely,

Robert L. Pascarelli, 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

REQUEST FOR RELIEF N1-I4-LMT-001 REGARDING

LIMITED EXAMINATION COVERAGE

NORTH ANNA POWER STATION UNIT 1

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)

DOCKET NUMBER 50-338

1.0 INTRODUCTION

By letter dated November 1, 2012, Agencywide Documents Access and Management System (ADAMS) Accession No. ML12319A278), as supplemented by letters dated April 5, 2013, and July 12, 2013 (ADAMS Accession Nos. ML13102A298 and ML13198A091, respectively), and clarification emails dated July 17, 2013, and August 7, 2013 (ADAMS Accession Nos. ML13226A368 and ML13220A056, respectively), Virginia Electric and Power Company (the licensee) submitted relief request (RR) N1-I4-LMT-001 for the U.S. Nuclear Regulatory Commission (NRC) review and approval. The licensee requested relief from a certain requirement of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, (or hereafter called the Code) related to essentially 100 percent coverage of examination volume or surface area. RR N1-I4-LMT-001 is applicable for the fourth 10-year inservice inspection (ISI) interval at the North Anna Power Station (North Anna), Unit 1, which commenced on May 1, 2009 and will end on April 30, 2019.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief and to use alternative requirements (if necessary), for inservice inspection items identified in RR N1-I4-LMT-001 on the basis that the Code requirement is impractical.

2.0 REGULATORY REQUIREMENTS

10 CFR 50.55a(g)(4) specifies that 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 conditions listed therein.

10 CFR 50.55a(g)(5)(iii) states that if the licensee has determined that conformance with certain ASME Code requirements is impractical for its facility, the licensee shall notify the Commission and submit, as specified in §50.4, information to support the determinations. Pursuant to 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations under paragraph (g)(5) of 10 CFR 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines 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.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the Commission to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 The Licensee'e Relief Request

3.1.1 ASME Code Components Affected

A1. Pressurizer Nozzle-to-Vessel Welds

ASME Code Class:	Class 1
Examination Category:	B-D, Full Penetration Welded Nozzles in Vessels – Inspection Program B, Table IWB-2500-1
Item No.:	B3.110
Component:	Pressurizer Nozzle-to-Vessel Welds
System:	Reactor Coolant System

The affected components for this examination category are listed in Attachment A1 to RRN1-I4-LMT-001.

R1. Risk-Informed Piping Welds Subject to Thermal Fatigue

ASME Code Class:	Class 1
Examination Category:	R-A
Item No.:	R1.11
System:	Reactor Coolant System

The affected components for this examination category are listed in Attachment R1 to RR N1-I4-LMT-001.

R2. Risk-Informed Piping Welds Subject to Intergranular (IGSCC) or Transgranular Stress Corrosion Cracking (TGSCC)

ASME Code Class:	Class 1
Examination Category:	R-A
Item No.:	R1.16
System:	Safety Injection System

The affected components for this examination category are listed in Attachment R2 to RR N1-I4-LMT-001.

R3. Risk-Informed Piping Welds

ASME Code Class:	Class 1
Examination Category:	R-A
Item No.:	R1.20
System:	Reactor Coolant System, Chemical and Volume Control System
ASME Code Class:	Non-Class (Non-Class welds classified as high safety significant, break exclusion region, per the North Anna risk informed ISI program)
Examination Category:	R-A
Item No.:	R1.20
System:	Main Steam System

The affected components for this examination category are listed in Attachment R3 to RR N1-I4-LMT-001.

3.1.2 Applicable Code Edition and Addenda

The code of record for the fourth 10-year ISI interval at North Anna, Unit 1, is the 2004 Edition with no Addenda of the ASME Code, Section XI.

3.1.3 Applicable Code Requirement

IWB-2500, Table IWB-2500-1, Examination Category B-D, Item No. B3.110, requires 100 percent coverage of the examination volume.

The licensee has implemented a risk informed (RI)-ISI program that was approved by the NRC for use in a letter dated January 21, 2011, (ADAMS Accession No. ML110050003). Per the RI-ISI program, the affected components noted above receive an ultrasonic examination and 100 percent coverage of its required examination volume.

Code Case N-460 "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1" allows a reduction in examination coverage on any Class 1 or Class 2 weld provided that the reduction in coverage for that weld is less than 10 percent. The NRC has accepted this code case in Regulatory Guide (RG) 1.147, Rev. 16.

3.1.4 Proposed Alternative and Basis

It is proposed that the examinations already completed at the reduced coverage be counted as meeting the Code requirements. Alternative components could not be substituted for examination due to the mandatory selection requirements of the Code.

3.1.5 Duration of Relief

RR N1-I4-LMT-001 is applicable to the fourth 10-year ISI interval which commenced on May 1, 2009, and will end on April 30, 2019.

NRC Staff Evaluation

The NRC staff has evaluated RR N1-I4-LMT-001 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff focuses on whether a technical justification exists to support the determination that the Code requirement is impractical, imposing the requirements could result in a burden upon the facility, and the structural integrity or leak tightness of component is reasonably assured.

By letter dated April 5, 2013, the licensee provided additional information in response to the NRC staff questions.

> The licensee provided further details on the extent of the relief sought and corrected several errors in the request. For example, the scan angles shown on pages 13 and 20 of the relief request were mislabeled and the corresponding percentage for coverage on pages 15 and 22 of Enclosure A1-1 and A1-2 were reversed. The licensee corrected the examination volume dimensions on pages 35 and 40 of Enclosure R1 and pages 75, 80, 84, and 90 of Enclosure R3 and verified the calculated examination volumes.
>
> The licensee provided Code classification and piping system for the affected components noted in Section 3.1.1 of this safety evaluation. All affected welds are Code Class 1 except three welds in the main steam piping system that have no ASME classification. According to the North Anna RI-ISI program, these non-class welds were identified as high safety significant welds and volumetric examination is required.
>
> Regarding supplemental examinations or compensatory measures, the licensee responded that three welds (Non-Class welds) in the main steam system received augmented surface examination per the North Anna RI-ISI. The remaining welds in RR N1-I4-LMT-001 (Class 1 welds) received the visual (VT-2) examinations at the beginning of each refueling outage (per Boric Acid Corrosion Control Program) and at the end of every refueling outage (in accordance with the Code). Furthermore, the plant personnel walkdown the main steam lines regularly performing visual examination during normal operator rounds.
>
> The NRC staff notes that when the RI-ISI program was established, the welds with the same risk-significance subject to the same degradation mechanism shall be selected such that the Code required coverage of the examination volume is achievable. The licensee confirmed that there were no other welds as shown in Attachments R1, R2, and R3 to RR N1-I4-LMT-001 with the same risk-significance subject to the same degradation

mechanism having similar configuration within the same system that could be selected for examination to achieve the Code required coverage.

The NRC staff evaluation for each weld grouping follows.

A1. Pressurizer Nozzle-to-Vessel Welds

Table IWB-2500-1, Examination Category B-D, Item No. B3.110, requires ultrasonic testing of 100 percent of the examination volume. ASME Code Case N-460 allows for essentially 100 percent coverage of the examination volume. The licensee requested relief from essentially 100 percent coverage on the basis of impracticality due to components limitations (e.g., design geometry, obstructions, or access).

As described in Attachment A1 and demonstrated in Enclosure A1-1 and A1-2 to RR N1-I4-LMT-001, the predominant limitations that prevented the licensee's UT to achieve essentially 100 percent coverage were the nozzle geometry and cladding for Weld 10 (1-RC-E-2) and the weld location in relation to the nozzle for Weld 14 (1-RC-E-2). The licensee performed the UT primarily from one side, in lieu of both sides of the welds due to the pressurizer to nozzle weld configuration. The licensee indicated that obtaining the Code required coverage would not be possible with existing UT technologies due to design configuration of each nozzle. The NRC confirmed the design configuration would limit the effectiveness of alternative (advanced) UT technologies from increasing the coverage of the examination volume. In order to effectively increase the coverage, these welds would require design modifications and replacement. Therefore, the NRC staff finds that a technical justification exists to support the determination that the Code required coverage is impractical and if the Code requirements were imposed on the facility, these welds would require major design modifications and replacement which would be a burden upon the licensee.

Table 1 below summarizes the NRC staff review of UT results for each weld. The licensee's coverage obtained represents the aggregate coverage of all Code required UT performed as documented in Attachment A and Enclosure A1-1 and A1-2 of the relief request. The licensee performed the UT manually from the outside diameter (OD) surface with the procedure developed in accordance with Article 4 of Section V of the ASME Code. The licensee acknowledged that the examinations were performed to the extent possible and additional coverage would not be possible with the existing UT technology.

Table 1. Examination results for the pressurizer vessel to nozzle welds

Weld No. (Line No.)	Description of Weld [Material]	Volumetric Examination Coverage Achieved (Percent)	Unacceptable Indication
10 (1-RC-E-2)	Pressurizer safety valve nozzle to vessel weld [carbon steel pressurizer nozzle-to-vessel weld, austenitic stainless steel cladding, stainless steel insert, carbon steel pressurizer vessel heads]	80	No
14 (1-RC-E-2)	Pressurizer spray nozzle to vessel weld [carbon steel pressurizer nozzle-to-vessel weld, austenitic stainless steel cladding, stainless steel insert, carbon steel pressurizer vessel heads]	80	No

From review of the scan plots in Enclosure A1-1 and A1-2 of the relief request, the NRC staff has verified that the licensee's UT has covered the regions (i.e., the weld root and the heat affected zone (HAZ) of the base material near the inside diameter (ID) surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. The licensee did not identify any unacceptable indications.

Despite reduced coverage of the examination volume, the licensee's visual examinations performed at the beginning and end of every refueling outage will provide additional assurance that any pattern of degradation, if it were to occur, would be detected.

Therefore, the NRC staff finds that the volumetric examinations performed to the extent possible provide a reasonable assurance of structural integrity and a leak tightness of the subject welds. Compliance with the Code requirements would be a burden upon the licensee.

R1. Risk-Informed Piping Welds Subject to Thermal Fatigue

The North Anna RI-ISI program, Category R-A, Item R1.11, requires ultrasonic testing of 100 percent of the examination volume. Code Case N-460 allows for essentially 100 percent coverage of the examination volume. The licensee requested relief from the essentially 100 percent coverage requirement on the basis of impracticality due to component limitations (e.g., design geometry, obstructions, or access).

As described in Attachment R1 and demonstrated in Enclosure R1-1 through R1-4 to RR N1-I4-LMT-001, the predominant limitations that prevented the UT to achieve essentially 100 percent coverage were the valve to pipe configuration for Welds 15 (6"-RC-16), 20 (6"-RC-17), and 15 (6"-RC-21), and the centrifugally cast stainless steel component and the branch connection weld joint configuration including weld crown for Weld SW-41 (27½"-RC-3). The licensee performed a single-sided UT due to the limitations mentioned above. The licensee indicated that obtaining the Code required coverage would not be possible with existing UT technologies

because of design configuration or material type (austenitic and cast stainless steel), or both. The NRC staff confirmed that the design configuration and material type would limit the effectiveness of alternative (advanced) UT technologies from increasing the coverage of the examination volume. In order to effectively increase the coverage, these components would require design modifications and replacement. Therefore, the NRC staff finds that a technical justification exists to support the determination that the Code requirements is impractical and if the requirements were imposed on the facility, these welds would be required to be redesigned and replaced which would be a burden upon the licensee.

Table 2 below summarizes the NRC staff review of UT results for each weld. The licensee's coverage obtained represents the aggregate coverage of all Code required UT performed as documented in Attachment R1 and Enclosure R1-1 through R1-4. The UT was performed from one side of the weld due to the limitations mentioned earlier. The coverage was limited to the volume up to the weld centerline (near-side), because claiming coverage for the volume on the far-side requires meeting the 10 CFR 50.55a(b)(2)(xv)(A)(2) far-side UT qualifications, which has not been demonstrated in any qualification attempts to date. For clarity, a near-side is referred to the side of the weld centerline that the ultrasonic probe sits and the near-side examination is referred to the examination of near-side volume up to the weld centerline. A far-side is the opposite side of the weld centerline. The licensee performed the near-side UT manually from the OD surface with the procedure developed in accordance with the performance demonstration requirements of Appendix VIII of the Code. The licensee acknowledged that the examinations were performed to the extent possible and additional coverage would not be possible with the existing technology.

As an extra effort to interrogate the volume on the far-side volume in a single-sided examination, the licensee conducted a supplemental UT using 60 degree refracted longitudinal waves. The 60 degree refracted longitudinal waves have better penetration capability in cast and austenitic stainless steel materials. The "Best Effort" percentage coverage shown in Table 2 below represents the far-side examination volume that does not meet the requirements of 10 CFR 50.55a(b)(2)(xv)(A)(2), therefore, it is not included in the aggregate coverage.

Table 2. Examination results for the risk informed piping welds subject to thermal fatigue

Weld No. Line No.	Description Weld Location [Material]	Volumetric Examination Coverage Achieved (percent)	Unacceptable Indication
15 (6"-RC-16)	Weld on discharge side of safety injection check valve 1-SI-99 injection pipe to reactor coolant hot leg (29"-RC-1) [Type 316 stainless steel pipe, filler metal SFA5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50 (Best Effort +9)	No
20 (6"-RC-17)	Weld on discharge side of safety injection check valve 1-SI-83, fit up to an elbow, in injection pipe to reactor coolant cold leg (27½"-RC-3) [Type 316 stainless steel pipe, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50 (Best Effort +7)	No
SW-41 (27½"-RC-3)	Branch connection nozzle to reactor coolant cold leg weld (6"-RC-17 to 27½"-RC-3) [Piping is centrifugally cast stainless steel material conforming to ASTM A-351 CF8, stainless steel A-182 F-316 nozzle, filler metal Type 308]	60	No
15 (6"-RC-21)	Weld on discharge side of safety injection check valve 1-SI-103, fit up to an elbow, to injection pipe to reactor coolant hot leg (29"-RC-7) [Type 316 stainless steel pipe, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50 (Best Effort +14)	No

From review of the scan plots in Enclosure R1-1 through R1-4 of the relief request, the NRC staff determined that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and HAZ of the base material near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. Except for Weld SW-41 (27½"-RC-3) that most of far-side volume (weld root and HAZ) was not examined due to the limitations. The licensee did not identify any unacceptable indications in any of the welds listed in Table 2. By email dated August 7, 2013, the licensee stated that it inspected other similar welds that were susceptible to thermal fatigue and contained the same filler weld material as Weld SW-41 (27½"-RC-3) in the fourth 10-year ISI interval. The licensee obtained greater than 90 percent coverage of the required volume of these other similar welds and the examination results did not identified any rejectable indication. In addition, review of the North Anna and industry operating experience (OE) indicated that there has not been any evidence of

degradation by thermal fatigue in branch connection line weldolets similar to Weld SW-41 (27½"-RC-3). On the basis of the above evaluation, the NRC staff finds the examination of Weld SW-41 (27½"-RC-3) acceptable.

Despite reduced coverage of the examination volume, the licensee's visual examinations performed at the beginning and end of every refueling outage will provide additional assurance that any pattern of degradation, if it were to occur, would be detected.

Therefore, the NRC staff finds that the licensee's volumetric examinations performed to the extent possible provide a reasonable assurance of structural integrity and a leak tightness of the subject welds. Compliance with the Code requirements would be a burden upon the licensee.

R2. Risk-Informed Piping Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking

The North Anna RI-ISI program, Category R-A, Item R1.16, requires ultrasonic testing of 100 percent of the examination volume. Code Case N-460 allows for essentially 100 percent coverage of the examination volume. The licensee requested relief from the essentially 100 percent coverage requirement on the basis of impracticality due to component limitations (e.g., design geometry, obstructions, or access).

As described in Attachment R2 and demonstrated in Enclosures R2-1 and R2-2 to RR N1-I4-LMT-001, the predominant limitation that prevented the UT to achieve essentially 100 percent coverage was the pipe to valve configurations for Welds 19 (6"-S1-131) and 8 (12"-SI-67). The licensee performed a single-sided UT due to the limitations mentioned above. The licensee indicated that obtaining the Code required coverage would not be possible with existing UT technologies due to design configuration or material type (austenitic and cast stainless steel), or both. The NRC staff confirmed the design configuration and material type would limit the effectiveness of alternative (advanced) UT technologies from increasing the coverage of the examination volume. In order to effectively increase the coverage, these welds would require design modifications and replacement. Therefore, the NRC staff finds that a technical justification exists to support the determination that the Code requirements is impractical and if the requirements were imposed on the facility, these welds would require major design modifications and replacement which would be a burden upon the licensee.

Table 3 below summarizes the NRC staff review of the licensee's UT results for each weld. The coverage obtained represents the aggregate coverage of all Code required UT performed as documented in Attachment R2 and Enclosures R2-1 and R2-2 of the relief request. The UT was performed from one side of the weld due to the limitations mentioned earlier. The coverage was limited to the volume up to the weld centerline (near-side). The licensee could not examine the volume on the far-side because the licensee's UT could not satisfy the requirements of 10 CFR 50.55a(b)(2)(xv)(A)(2). The licensee performed the near-side UT manually from the OD surface with the procedure developed in accordance with the performance demonstration requirements of Appendix VIII of the Code. The licensee acknowledged that the examinations were performed to the extent possible and additional coverage would not be possible with the existing technology.

As an extra effort to interrogate the volume on the far-side in a single-sided examination, the licensee conducted a supplemental UT using 60 degree refracted longitudinal waves. The 60

degree refracted longitudinal waves have better penetration capability in cast and austenitic stainless steel materials. The "Best Effort" percentage coverage shown in Table 3 below represents the far-side examination volume that does not meet the requirements of 10 CFR 50.55a(b)(2)(xv)(A)(2), therefore, it is not included in the aggregate coverage.

Table 3. Examination results for the risk informed piping welds subject to IGSCC or TGSCC

Weld No. Line No.	**Description Weld Location [Material]**	**Volumetric Examination Coverage Achieved (percent)**	**Unacceptable Indication**
19 (6"-S1-131)	Weld on upstream side of safety injection check valve 1-SI-83, in injection pipe to reactor coolant cold leg (27½"-RC-3) [Type 316 stainless steel piping with welding filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and/or SFA 5.30 1N316L]	50 (Best Effort +5)	No
8 (12"-SI-67)	Weld on upstream side of safety injection check valve 1-SI-127, in injection pipe to reactor coolant cold leg (271½"-RC-3) from accumulator tank 1 [Type 316 stainless steel piping with welding filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50 (Best Effort +15)	Yes (Root geometry)

From review of the scan plots in Enclosure R2-1 and R2-2 of the relief request, the NRC staff determined that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and HAZ of the base material near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. In letter dated July 12, 2013, the licensee provided additional information in response to the NRC staff questions regarding one indication that was identified in Weld 8 (12"-SI-67). The NRC staff finds that this indication was evaluated by the UT procedure that was qualified in accordance with Appendix VIII. The UT procedure has guidance for discriminating flaw from other geometrical features. The licensee used this guidance to evaluate the indication in Weld 8 (12"-SI-67) and the indication was determined to be root geometry. Weld 8 (12"-SI-67) was not previously examined. There were no other unacceptable indications identified in the subject welds.

Despite reduced coverage of the examination volume, the licensee's visual examinations performed at the beginning and end of every refueling outage will provide additional assurance that any pattern of degradation, if it were to occur, in these welds would be detected.

Therefore, the NRC staff finds that the volumetric examinations performed to the extent possible provides a reasonable assurance of structural integrity and a leak tightness of the subject welds. Compliance with the Code requirements would be a burden upon the licensee.

R3. Risk-Informed Piping Welds (Not Subject to a Degradation Mechanism)
The North Anna RI-ISI program, Category R-A, Item R1.20, requires ultrasonic testing of 100 percent of the examination volume. Code Case N-460 allows for essentially 100 percent coverage of the examination volume. The licensee requested relief from essentially 100 percent coverage on the basis of impracticality due to components limitations (e.g., design geometry, obstructions, or access).

As described in Attachment R3 and demonstrated in Enclosure R3-1 through R3-7 to RR N1-I4-LMT-001, the predominant limitations that prevented the UT to achieve essentially 100 percent coverage were the pipe to valve configuration for Weld 1 (8"-RC-11), the valve to pipe configuration for Weld 4 (8"-RC-11), the pipe to tee configuration for Weld 1 (4"-CH-A14), the right angle between the pipe and the header for Welds SW-10 (32"-SHP-57), SW-12 (32"-SHP-58), and SW-11 (32"-SHP-59), and the pipe to tee configuration for Weld 35 (4"-RC-15). The licensee indicated that obtaining the Code required coverage would not be possible with existing UT technologies due to design configuration or material type (austenitic and cast stainless steel), or both. The NRC staff confirmed that the design configuration and material type would limit the effectiveness of alternative (advanced) UT technologies from increasing the examination coverage. In order to effectively increase the examination coverage, these welds would require design modifications and replacement. Therefore, the NRC staff finds that a technical justification exists to support the determination that the Code requirements is impractical and if the requirements were imposed on the facility, these welds would be required to be redesigned and replaced which would be a burden upon the licensee.

Table 4 below summarizes the NRC staff review of UT results for each weld. The coverage obtained represents the aggregate coverage of all Code required UT performed as documented in Attachment R3 and Enclosure R3-1 through R3-7 of the relief request. For Welds 1 (8"-RC-11) and 4 (8"-RC-11) with associated cast stainless steel and austenitic stainless steel components, the UT was performed from both sides of weld if the limitations mentioned earlier permitted, otherwise a single-sided UT was performed. The licensee performed the UT manually from the OD surface with procedures developed in accordance with the performance demonstration requirements of Appendix VIII of the Code.

For Welds 1 (4"-CH-A14) and 35 (4"-RC-15) with austenitic stainless steel components, the UT was performed from a single side due to the limitations mentioned earlier. The coverage was only limited to the volume up to the weld centerline (near-side). The licensee could not examine the volume on the far-side because the licensee's UT could not satisfy the requirements of 10 CFR 50.55a(b)(2)(xv)(A)(2). The licensee performed the near-side UT manually from the OD surface with procedures developed in accordance with the performance demonstration requirements of Appendix VIII of the Code.

For Welds SW-10 (32"-SHP-57), SW-12 (32"-SHP-58), and SW-11 (32"-SHP-59) with carbon steel components, the UT was performed from both sides of the weld, but the region where the pipe and the header is at a right angle could not be examined due to component configuration. The licensee performed the UT manually from the OD surface with a procedure developed in accordance with the performance demonstration requirements of Appendix VIII of the Code.

The licensee indicated that the examinations were performed to the extent possible and additional coverage would not be possible with the existing technology.

As an extra effort to interrogate the volume on the far-side in a single-sided examination, the licensee conducted a supplemental UT using 60 degree refracted longitudinal waves. The 60 degree refracted longitudinal waves have better penetration capability in cast and austenitic stainless steel materials. The "Best Effort" percentage coverage shown in Table 4 represents the far-side examination volume that does not meet the requirements of 10 CFR 50.55a(b)(2)(xv)(A)(2), therefore, it is not included in the aggregate coverage.

Table 4. Examination results for the risk informed piping welds

Weld No. Line No.	**Description of Weld [Material]**	**Volumetric Examination Coverage Achieved (percent)**	**Unacceptable Indication (Type)**
1 (8"-RC-11)	Loop bypass piping to loop stop valve body [Type 316 stainless steel pipe, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L, valve body SA351-CF8M cast stainless steel]	75 (Best Effort +15)	No
4 (8"-RC-11)	Loop stop valve body to loop bypass piping [Type 316 stainless steel pipe, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L, valve body SA351-CF8M cast stainless steel]	50 (Best Effort +10)	No
1 (4"-CH-A14)	4-inch pipe to tee in pressurizer auxiliary spray piping [stainless steel pipe A376-TP316 Sch 160, stainless steel tee A403-WP316 Sch 160, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50 (Best Effort +3)	No
35 (4"-RC-15)	4-inch tee to pipe in pressurizer auxiliary spray piping [stainless steel pipe A376-TP316 Sch 160, stainless steel tee A403-WP316 Sch 160, filler metal SFA 5.4 E316L-16, SFA 5.9 ER316L, and or SFA 5.30 1N316L]	50% (Best Effort +1.6)	No
SW-10 (32"-SHP-57)	Main steam piping from containment to main steam header weld [carbon steel pipe A155EFW, CLI, CMS 75, carbon steel header A155EFW, CLI, KC 70]	87	No

SW-12 (32"-SHP-58)	Main steam piping from containment to main steam header weld [carbon steel pipe A155EFW, CLI, CMS 75, carbon steel header A155EFW, CLI, KC 70]	87	Yes (Root geometry)
SW-11 (32"-SHP-59)	Main steam piping from containment to main steam header weld [carbon steel pipe A155EFW, CLI, CMS 75, carbon steel header A155EFW, CLI, KC 70]	87	No

From review of the scan plots in Enclosure R3-1 through R3-7 of the relief request, the NRC staff determined that the licensee's UT has covered to the extent possible the regions (i.e., the weld root and the HAZ of the base material near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. In letter dated July 12, 2013, as supplemented by email dated July 17, 2013, the licensee provided additional information in response to the NRC staff questions regarding one indication that was identified in Weld SW-12 (32"-SHP-58). The licensee noted that this indication was evaluated by the UT procedure that was qualified in accordance with Appendix VIII. The UT procedure has guidance for discriminating a flaw from other geometrical features. The indication identified in Weld SW-12 (32"-SHP-58) was determined to be root geometry in accordance with this guidance. This weld had previously been examined three times and the indication (root geometry) was recorded two of those three examinations. No changes in the characteristics of the indication were observed in the previous examinations. Every time the UT was performed on this weld, the examination history of this weld was provided to the examiner. The licensee's justification for not recording the indication (root geometry) one of those three examinations was that if the same indication (root geometry) identified previously had no characteristic changes, the examiner may not record that same indication again. The NRC staff finds that the licensee addressed the questions regarding the indication in Weld SW-12 (32"-SHP-58) adequately. There were no other unacceptable indications identified in the subject welds.

Despite reduced coverage of the examination volume, the three welds in the main steam lines (Welds SW-10 (32"-SHP-57), SW-12 (32"-SHP-58), and SW-11 (32"-SHP-59)) were subject to augmented surface (magnetic particle) examinations per the North Anna Augmented ISI program. The surface examinations obtained essentially 100 percent coverage. The remaining welds in R3 received visual examinations at the beginning and end of every refueling outage. These augmented or visual examinations provided additional assurance that any pattern of degradation, if it were to occur in these welds, would be detected.

Therefore, the NRC staff finds that the volumetric examinations performed to the extent possible provides a reasonable assurance of structural integrity and leak tightness of the subject welds. Compliance with the Code requirements for these welds would be a burden upon the licensee.

4.0 CONCLUSION

As set forth above, the NRC staff determines that it is impractical for the licensee to comply with the ASME Code, Section XI requirement. The NRC staff also determines that the extent of volumetric examinations accompanied with other examinations (visual or augmented, or

regularly walked down) provide reasonable assurance of structural integrity or leak tightness of the subject component. Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii), and is in compliance with the requirements of the ASME Code, Section XI, for which the relief was not requested. Therefore, the NRC staff grants RR N1-I4-LMT-001 at North Anna, Unit 1, for the fourth 10-year ISI interval which commenced on May 1, 2009, and will end on April 30, 2019.

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

Principal Contributor: Ali Rezai, NRR
John Tsao, NRR

Date: August 30, 2013

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

Sincerely,

/RA/

Robert L. Pascarelli, 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	RidsNrrDorlLpl2-1 Resource	RidsNrrLASFigueroa Resource
RidsNrrDeEvib	RidsRgn2MailCenter Resource	RidsNrrPMNorthAnna Resource
MKotzalas, EDO	RidsAcrsAcnw_MailCTR Resource	ARezai, NRR
	JTsao, NRR	TLupold, NRR

ADAMS Accession No.: ML13234A353 ***e-mail memo transmitted SE dated 08/9/13**

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	NRR/DE/EPNB/BC	NRR/LPL2-1/BC	NRR/LPL2-1/PM
NAME	VSreenivas	SFigueroa	TLupold*	RPascarelli	VSreenivas
DATE	08/27/13	08/26/13	08/09/2013	08/30/13	08/30/13

OFFICIAL RECORD COPY