



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

January 15, 2021

Mr. Daniel G. Stoddard  
Senior Vice President and Chief Nuclear Officer  
Innsbrook Technical Center  
5000 Dominion Blvd.  
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION, UNIT NO. 1 - RE: REQUEST FOR RELIEF  
REQUEST N1-I4-LMT-003 INSERVICE INSPECTION LIMITATIONS  
(EPID L-2020-LLR-0071)

Dear Mr. Stoddard:

By letter dated April 30, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20121A119), as supplemented by letter dated October 22, 2020 (ADAMS Accession No. ML20296A667), Virginia Electric and Power Company (VEPCO, Dominion Energy Virginia, the licensee), submitted Relief Request No. N1-14-LMT-003 for the North Anna Power Station, Unit 1 (NAPS1), to the U.S. Nuclear Regulatory Commission (NRC or Commission) for review and approval, pursuant to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g)(6)(i).

Specifically, the requested relief is on the basis that the required examination coverage was impractical due to physical obstructions and limitations imposed by design, geometry, and materials of construction of the subject components.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that VEPCO has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii) and demonstrated that achieving the required examination coverage is impractical for North Anna, Unit 1, for the Fourth Inservice Inspection (ISI) Program Test interval, which ended on April 30, 2019.

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

If you have any questions, please contact the Project Manager, Ed Miller at 301-415-2481 or via e-mail at [Ed.Miller@nrc.gov](mailto:Ed.Miller@nrc.gov).

Sincerely,

Michael T. Markley, Chief  
Plant Licensing Branch 2-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-338

Enclosure:  
Safety Evaluation

cc: Listserv



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

PROPOSED INSERVICE INSPECTION ALTERNATIVE N1-I4-LMT-003

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION ENERGY VIRGINIA)

NORTH ANNA POWER STATION, UNIT 1

DOCKET NO. 50-338

1.0 INTRODUCTION

By letter dated April 30, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20121A119), Virginia Electric and Power Company (Dominion, the licensee) submitted relief request N1-I4-LMT-003 requesting relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," at North Anna Power Station, Unit 1 (NAPS 1). Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (CFR) 50.55a, "Codes and Standards," paragraph (g)(5)(iii), the licensee requested relief on the basis that the required examination coverage was impractical due to physical obstructions and limitations imposed by design, geometry and materials of construction of the subject components. By letter dated October 22, 2020 (ADAMS Accession No. ML20296A667), the licensee provided supplemental information in response to a U. S. Nuclear Regulatory Commission (NRC) staff request for additional information.

2.0 REGULATORY EVALUATION

Pursuant to 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 In-service Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The regulation in 10 CFR 50.55a(g)(5)(iii) states that "...If the licensee has determined that conformance with a code requirement is impractical for its facility, the licensee shall notify the (NRC) and submit, as specified in Section 50.4, information to support the determinations. Determinations of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the code requirements

during the ISI interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought."

The regulation at 10 CFR 50.55a(g)(6)(i) states that, "...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...."

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 NRC staff to grant the relief requested by the licensee.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee's Proposed Alternative

##### Applicable Code Edition and Addenda

The applicable code for the NAPS1 Fourth 10-Year ISI Interval and ISI Program is the ASME Code, Section XI, 2004 Edition, with no Addenda. The NAPS1 Fourth 10-Year ISI interval ended on April 30, 2019.

##### American Society of Mechanical Engineers (ASME) Code Components Affected

###### ASME Code Class 1 Welds

Exam Category: B-D, Full Penetration Welded Nozzles in Vessels  
Item Number: B3.110, Pressurizer Nozzle-to-Vessel Welds  
Weld Identification: 1-RC-E-2, Weld 13

Exam Category: R-A, Risk-Informed Piping Examinations  
Item Number: R1.11, Elements Subject to Thermal Fatigue  
Weld Identification: 6-RC-17, Weld 21  
6-RC-20, Weld 41  
6-RC-20, Weld 42

Exam Category: R-A, Risk-Informed Piping Examinations  
Item Number: R1.16, Elements Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)  
Weld Identification: 6-SI-133, Weld 12

Exam Category: R-A, Risk-Informed Piping Examinations  
Item Number: R1.20, Elements Not Subject to a Degradation Mechanism  
Weld Identification: 8-RC-12, Weld 1  
27 ½ -RC-9, Weld 33  
29-RC-7, Weld SW-31  
6-SI-131, Weld SW-7  
12-SI-69, Weld SW-8  
6-RC-21, Weld 18  
29-RC-7, Weld 27  
14-RH-1, Weld 4

ASME Code Class 2 Welds

Exam Category: C-B, Pressure Retaining Nozzle Welds in Vessels  
Item Number: C2.21, Nozzle-to-Shell Welds  
Weld Identification: 1-SI-TK-2, Weld 3  
1-SI-TK-2, Weld 4

ASME Code Requirement for Which Alternative Is Requested

Section XI, of ASME Code, 2004 Edition, Examination Category B-D requires 100 percent volumetric examination coverage of the pressure retaining welds as defined in Table IWB-2500-1.

Section XI, of ASME Code, 2004 Edition, Examination Category C-B requires 100 percent surface and volumetric examination coverage of the pressure-retaining welds as defined in Table IWC-2500-1.

The examination requirements for Class 1 piping welds are governed by the Risk-Informed/ Safety-Based Inservice Inspection (RI-ISI) Program Plan which was developed in accordance with ASME Code Case N-716, "Alternative Classification and Examination Requirements, Section XI, Division 1." Table 1 of Code Case N-716 requires that Examination Category R-A, Item No. R1.11, R1.16 and R1.20 welds receive essentially 100 percent volumetric examinations. ASME Code Class 1, Examination Category R-A, Item No. R1.20 pertains to High Safety Significant (HSS) pressure-retaining welds which are not subject to any degradation method while Item Nos. R1.16 and R1.11 are HSS pressure-retaining welds subject to IGSCC or TGSCC and thermal fatigue, respectively. The RI-ISI program was approved by the NRC staff for NAPS 1 by letter dated January 21, 2011 (ADAMS Accession No. ML110050003).

The licensee adopted ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1," which defines "essentially 100 percent" as greater than 90 percent coverage of the examination volume or surface area, as applicable. The 90 percent minimum coverage was applied to all surface and volumetric examinations required by ASME Code, Section XI.

Section XI, of ASME Code, 2004 Edition, Mandatory Appendix I, Article I-2120 requires that ultrasonic examination of vessels other than reactor vessels greater than 2 inches in thickness shall be conducted in accordance with Section V, Article 4.

### Impracticality of Compliance

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that meeting the essentially 100 percent volumetric examination requirement is impractical. The requirement is considered impractical primarily due to single-side access and configuration of the components. Specifically, conformance to the requirement would require extensive modifications to, or replacement of, the subject components to make the examination volume more accessible. Implementing these adjustments would have an impact on other associated plant equipment, create an excessive financial burden for the licensee, and increase radiation exposure to staff.

The licensee determined that most of the risk-informed welds were examined using manual advanced ASME Section XI, Appendix VIII demonstrated procedures in accordance with Performance Demonstration Initiative (PDI). The remaining welds covered in the request were examined to the maximum extent possible using qualified ultrasonic testing (UT) techniques in accordance with ASME Code, Section V, Article 4 and Section XI, Appendix III. Additional magnetic particle and liquid penetration surface examinations were performed on C-B welds and one of the R-A welds, respectively. Non-ASME Code credited best effort examinations were also performed on most of the R-A welds. The subject welds are included in the Class 1 pressure boundary and, therefore, receive visual examinations at the beginning of each refueling outage as part of the Boric Acid Corrosion Control Program and VT-2 visual examinations at the end of the refueling outage once operating pressure and temperature is achieved before unit startup.

Due to the configuration of the subject components, the welds are adjacent to surfaces and obstructions which inhibit full volumetric examination. The proximity of the welds to tapered surfaces and other nearby objects limits the access of the transducer to a single side of the weld, resultantly limiting the ability to perform the complete examination to that side of the weld. Single-sided UT scans through carbon steel have been shown to be effective in detecting flaws due to their fine-grained microstructures. However, there are currently no PDI-qualified single-sided examination procedures that demonstrate equivalency to two-sided examination procedures on austenitic piping welds. None of the current technology is capable of reliably detecting or sizing flaws on the opposite side of an austenitic weld. The licensee determined that no alternative methods or other advanced technologies could obtain complete coverage of the examination volume due to the access and physical limitations.

Therefore, the licensee requested relief from complying with the ASME Code-required volumetric examinations of the subject components.

### Proposed Alternative and Basis for Use

In lieu of satisfying the examination coverage in accordance with the ASME Code, Section XI requirement, the licensee proposed the alternate examination coverage for the subject welds shown in Table 1 of the relief request. The basis of the proposed alternative is that the licensee has performed the ASME Code, Section XI-required examinations to the maximum extent practical utilizing qualified personnel, techniques, and equipment. The licensee explained that due to the physical interferences causing these limitations, there are no alternative examination techniques currently available to increase coverage. Furthermore, in combination with additional monitoring methods that the welds are subject to the examinations performed provide reasonable assurance that service-induced degradation or leakage will be detected.

### Duration of Proposed Alternative

The licensee submitted this relief request for the fourth 10-year ISI interval which started on May 1, 2009, and ended on April 30, 2019.

### 3.2 NRC Staff Evaluation

#### Category B-D, Item Number B3.110 – Pressurizer Nozzle-to-Vessel Welds

The licensee claimed to obtain 51.89 percent examination coverage of Pressurizer Nozzle-To-Shell Weld 13 (1-RC-E-2). The licensee stated the scans were limited to a single side of the weld due to the configuration of the nozzle. The NRC staff confirmed that the geometry of the nozzle restricted access to volumetric examination as stated by the licensee, and that it would be impractical to achieve greater than essentially 100 percent volumetric coverage without extensive weld or component design modifications. The NRC staff also confirmed that volumetric examination in accordance with Article 4, Section V of the ASME Code was acceptable since Article I-2120 of the ASME Code, Section XI requires ultrasonic examination of all other vessels greater than 2 inches in thickness to be conducted in accordance with Article 4 of Section V. No recordable indications were observed during the exams.

#### Category C-B, Item Number C2.21 – Nozzle-to-Shell Welds

The licensee claimed to obtain 39 percent examination coverage of Nozzle-To-Shell Welds 3 and 4 of 1-SI-TK-2. The licensee stated that the scans were limited to a single side of each weld due to the configuration of the nozzle. The NRC staff confirmed that the geometry of the nozzle restricted access to volumetric examination as stated by the licensee, and that it would be impractical to achieve greater than essentially 100 percent volumetric coverage without extensive weld or component design modifications. The NRC staff also confirmed that volumetric examination in accordance with Article 4, Section V of the ASME Code was acceptable since Article I-2120 of the ASME Code, Section XI requires ultrasonic examination of all other vessels greater than 2 inches in thickness to be conducted in accordance with Article 4 of Section V. Access for surface examination was not restricted and the licensee was able to achieve 100 percent coverage for the surface examination required by Table IWC-2500-1 for Examination Category C-B, Item No. C2.21 welds. No recordable indications were observed during the examinations.

#### Category R-A, Item Number R1.11 - Elements Subject to Thermal Fatigue

The licensee claimed to obtain 50 percent examination coverage of Reactor Coolant (RC) System Class 1 Elbow-To-Branch Weld 21 (6-RC-17) and Valve-To-Elbow Weld 41 (6-RC-20). The licensee also claimed to obtain 45.19 percent examination coverage of Reactor Coolant System Class 1 Pipe-To-Branch Weld 42 (6-RC-20). The licensee attributed the limitations in obtaining further coverage primarily to the component configurations which hindered downstream scans of Welds 21 and 42, and upstream scans on Weld 41. Particularly, the proximity of the welds to the branches and valve does not provide sufficient distance for the scanner to perform any examinations from the tapered side of each weld. Enclosures R1-1, R1-2 and R1-3 of the submittal contain the complete Ultrasonic Examination Data Record for the welds. Included in this record are the scan plots detailing the required volumetric coverage, the UT beams used in the examination, the actual coverage obtained and the limitations preventing further examination. The NRC staff reviewed the diagrams and confirmed the examination coverage obtained, the licensee's calculations, and that no further coverage could

be obtained. Additionally, the licensee performed best-effort examinations and obtained an additional 25 percent, 15.9 percent and 14.25 percent coverage of the unobtainable side of welds 21, 41 and 42 respectively, though it cannot be credited to the code required examination coverage. Furthermore, Weld 41 is managed as part of the augmented thermal fatigue examination requirements in Materials Reliability Program 146 (MRP-146) "Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines." The NRC staff finds that the percentage of examination coverage is reasonably calculated, and further coverage is not feasible. No recordable indications were observed during the exams.

#### Category R-A, Item Number R1.16 - Elements Subject to Intergranular or Transgranular Stress Corrosion Cracking

The licensee claimed to obtain 50 percent examination coverage of Safety Injection (SI) System Class 1 Pipe-to-Valve Weld 12 (6-SI-133). The licensee attributed the limitations in obtaining further coverage to the proximity of the weld to the taper of the valve which does not provide sufficient distance for the scanner to perform any examinations from the downstream side of the weld. Enclosure R2-1 of the submittal contains the complete Ultrasonic Examination Data Record for the weld. Included in this record are the scan plots detailing the required volumetric coverage, the UT beams used in the examination, the actual coverage obtained and the limitations preventing further examination. The NRC staff reviewed the diagrams and confirmed the examination coverages obtained, the licensee's calculations, and that no further coverage could be obtained. Additionally, the licensee performed best-effort examinations from the pipe side of the weld and obtained an additional 16.6 percent coverage of the valve side though it cannot be credited to the Code-required examination coverage. The NRC staff finds that the percentages of examination coverage are reasonably calculated, and further coverage is not feasible. No recordable indications were observed during the exams.

#### Category R-A, Item Number R1.20 - Elements Not Subject to a Degradation Mechanism

The licensee claimed to obtain 50 percent examination coverage of RC System Class 1 Pipe-To-Valve Weld 1 (8"-RC-12), RC System Class 1 Elbow-To-Branch Weld 18 (6-RC-21), and Residual Heat Removal (RHR) System Class 1 Pipe-To-Valve Weld 4 (14-RH-1); 75 percent examination coverage of RC System Class 1 Pump-To-Pipe Weld 33 (27½"-RC-9) and RC System Class 1 Branch Connection Weld SW-31 (29-RC-7); 74.5 percent examination coverage of Low Head SI System Class 1 Pipe-To-Elbow Weld SW-7 (6-SI-131); 87 percent examination coverage of SI System Class 1 Pipe-to-Elbow Weld SW-8 (12-SI-69); and 63 percent coverage of RC System Class 1 Valve-To-Pipe Weld 27 (29-RC-7). The licensee attributed the limitations in obtaining further coverage of these welds to the configuration of the components as well as the proximity of the welds to lugs, pipe clamps, supports, drain lines and miscellaneous instrumentation that precluding full scanner access and examination. Enclosures R3-1 – R3-8 of the submittal contain the complete Ultrasonic Examination Data Record for the welds. Included in these records are the scan plots detailing the required volumetric coverage, the UT beams used in the examination, the actual coverage obtained and the limitations preventing further examination. The NRC staff reviewed the diagrams and confirmed the examination coverage obtained, the licensee's calculations, and that no further coverage could be obtained. The NRC staff reviewed the diagrams and confirmed the examination coverages obtained, the licensee's calculations, and that no further coverages could be obtained. Supplementary best-effort examinations were performed where applicable on Welds 1, SW-7, SW-8, 18 and 4 obtaining an additional 3 percent - 25 percent coverage of the inaccessible portions of the welds though it cannot be credited to the Code-required examination coverage. Weld 18 is also managed as part of the augmented thermal fatigue examination requirements in MRP-146. The



NRC staff finds that the percentages of examination coverage are reasonably calculated, and further coverage is not feasible. No recordable indications were observed during the exams of the welds.

The examinations performed were limited due to the configuration of the components which restricted full examinations of the welds. The configurations also prevent alternative examination techniques from achieving greater credited coverage. The components were designed and fabricated prior to the examination requirements of ASME Code, Section XI being published; therefore the plant was not designed specifically to meet the requirements. The NRC staff finds these limitations to be an acceptable basis for impracticality of conforming to the requirements and finds that the modification necessary to achieve the required coverage constitutes a burden upon the licensee.

The required examination volumes include the volume surrounding the weld, weld heat affected zone, and base metal, where applicable, in the crevice region. The intent of the examinations is to detect cracks initiating and propagating from the inner surface. The licensee performed the required volumetric examination of the welds using UT to the extent practical and achieved the coverages stated above. The NRC staff reviewed the scan diagrams and coverage sheets, which showed that the examined volumes included weld and base materials in the inner region where degradation is expected to occur (if it occurs) and determined that the limited coverages for these welds are acceptable. Aside from the weld root geometric indications found in the preservice examinations, no recordable indications were observed.

In addition to the ASME Code-required volumetric examinations, the welds are subject to further defense-in-depth measures. These components are monitored for through-wall leakage as part of the ASME Code, Section XI System Pressure Test Program and receive a visual (VT-2) examination at the end of each refueling outage during system leakage tests as required by Section XI, Table IWB-2500-1, Category B-P for Class 1 components. Some components also receive visual examinations at the beginning of each refueling outage as part of the Boric Acid Corrosion Control Program. Furthermore, the licensee stated that some of the welds detailed in the relief request are within the scope of the Electric Power Research Institute (EPRI) MRP-146. The NRC staff finds that the coverage obtained with the UT examinations combined with augmented thermal fatigue examinations, visual examinations through the Boric Acid Corrosion Control Program, and ongoing leakage testing provides reasonable assurance that any significant service induced degradation would be observed and mitigated in a timely manner to maintain structural integrity.

Based on the above, the NRC staff determined that obtaining the ASME Code-required examination volume for the subject welds is impractical because of the stated limitations and that the modifications necessary to obtain the required coverage would impose an undue burden upon the licensee. The NRC staff determined that the licensee performed volumetric examinations to the maximum extent practical and the licensee has implemented compensatory measures that effectively monitor the weld volumes that could not be examined. Therefore, NRC staff finds it reasonable to conclude that any significant service-induced degradation that is present in these welds would have been detected. Lastly, the NRC staff concluded that there is reasonable assurance that the structural integrity of the welds will be maintained considering the following: the majority of the most susceptible portions of the welds were examined; no indications were found suggesting that cracks are not developing or growing from previous intervals; these welds will likely leak before breaking; and the licensee has defense-in-depth measures to monitor these welds for leakage. Based on operational experience and the extent to which the licensee performed examinations, the NRC staff has determined with reasonable

assurance that the structural integrity of these welds will be maintained throughout the fourth 10-year interval ISI program.

#### 4.0 CONCLUSION

As set forth above, the NRC staff has determined that it is impractical to satisfy the ASME Code-required greater than 90 percent examination coverage for the subject welds due to material and component configuration for UT. The NRC staff finds that imposition of the ASME Code requirements would result in an impracticality. The NRC staff determined that granting the relief request 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 impracticality of achieving the required examination coverage 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)(6)(i). Therefore, the NRC staff authorizes the use of Relief Request N1-14-LMT-003 at North Anna Power Station Unit 1 for the fourth ISI interval.

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

Principal Contributor: J. Jenkins, NRR  
A. Young, NRR

Date: January 15, 2021

SUBJECT: NORTH ANNA POWER STATION, UNIT NO. 1 - RE: REQUEST FOR RELIEF  
REQUEST N1-I4-LMT-003 INSERVICE INSPECTION LIMITATIONS  
(EPID L-2020-LLR-0071) DATED JANUARY 15, 2021

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\*Via SE Input

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