

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261

10 CFR 50.55a

July 27, 2016

United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Serial No. 16-266  
NAPS/MPW R0  
Docket Nos. 50-338  
50-339  
License Nos. NPF-4  
NPF-7

**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)**  
**NORTH ANNA POWER STATION UNITS 1 AND 2**  
**ASME SECTION XI INSERVICE INSPECTION PROGRAM**  
**PROPOSED INSERVICE INSPECTION ALTERNATIVE N1-I4-NDE-008**  
**PROPOSED INSERVICE INSPECTION ALTERNATIVE N2-I4-NDE-003**

In accordance with 10 CFR 50.55a(z)(1), Dominion hereby requests Nuclear Regulatory Commission (NRC) approval of proposed inservice inspection (ISI) alternative N1-I4-NDE-008 and N2-I4-NDE-003. The request is to extend the interval for reactor vessel Examination Category B-A and B-D pressure retaining welds from 10 years to 20 years in accordance with WCAP-16168-NP, Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval. The requests for alternatives are provided in Attachments 1 and 2.

Dominion requests approval of the proposed alternatives by August 1, 2017. If you have any questions, please contact Ms. Diane E. Aitken at (804) 273-2694.

Sincerely,



Mark Sartain  
Vice President Nuclear Engineering

This letter contains no NRC commitments.

Attachments

1. Proposed Alternative - N1-I4-NDE-008 in accordance with 10 CFR 50.55a(z)(1)
2. Proposed Alternative - N2-I4-NDE-003 in accordance with 10 CFR 50.55a(z)(1)

A047  
NRR

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**Attachment 1**

**Proposed Inservice Inspection Alternative N1-I4-NDE-008**

**In Accordance with 10 CFR 50.55a(z)(1)**

**Virginia Electric and Power Company (Dominion)**

## North Anna Power Station Unit 1

### REQUEST FOR ALTERNATIVE N1-I4-NDE-008 REACTOR VESSEL WELD EXAMINATION EXTENSION

*Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1)*

*-Alternative Provides Acceptable Level of Quality and Safety*

#### **1. ASME CODE COMPONENTS AFFECTED**

The affected component is the North Anna Unit 1 reactor vessel (RV); specifically, the following American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI (Reference 1) examination categories and item numbers covering examinations of the RV. These examination categories and item numbers are from IWB-2500 and Table IWB-2500-1 of the ASME BPV, Code Section XI.

Category B-A welds are defined as "Pressure Retaining Welds in Reactor Vessel"  
Category B-D welds are defined as "Full Penetration Welded Nozzles in Vessels"

#### **Examination**

<b>Category</b>	<b>Item No.</b>	<b>Description</b>
B-A	B1.10	Shell Welds
B-A	B1.11	Circumferential Shell Welds
B-A	B1.20	Head Welds
B-A	B1.21	Circumferential Head Welds
B-A	B1.22	Meridional Head Welds
B-A	B1.30	Shell-to-Flange Weld
B-A	B1.40	Head-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inside Radius Section

(Throughout this request the above examination categories are referred to as "the subject examinations" and the ASME BPV Code, Section XI, is referred to as "the Code.")

#### **2. APPLICABLE CODE EDITION AND ADDENDA**

North Anna Power Station Unit 1 (NAPS 1) applicable Code for the fourth 10-year inservice inspection (ISI) interval and the ISI program is the 2004 Edition of Section XI with no Addenda (Reference 1). NAPS 1 fourth interval started May 1, 2009 and ends April 30, 2019.

### **3. APPLICABLE CODE REQUIREMENTS**

IWB-2412, Inspection Program B, requires volumetric examination of essentially 100% of reactor vessel pressure-retaining welds identified in Table IWB-2500-1 once each 10-year interval. The North Anna Unit 1 fourth 10-year inservice inspection (ISI) interval is scheduled to end on April 30, 2019. The applicable Code for the fifth 10-year ISI interval will be selected in accordance with the requirements of 10 CFR 50.55a.

### **4. REASON FOR REQUEST**

An alternative is requested from the requirement of IWB-2412, Inspection Program B, that volumetric examination of essentially 100% of reactor vessel pressure-retaining Examination Category B-A and B-D welds be performed once each 10-year interval. Extension of the interval between examinations of Category B-A and B-D welds from 10 years to up to 20 years will result in a reduction in man-rem exposure and examination costs.

### **5. PROPOSED ALTERNATIVES AND BASIS FOR USE**

Dominion proposes not to perform the ASME Code required volumetric examination of the North Anna Unit 1 reactor vessel full penetration pressure-retaining Examination Category B-A and B-D welds for the fourth inservice inspection, currently scheduled for spring 2018. Dominion will perform the fourth ASME Code required volumetric examination of the North Anna Unit 1 reactor vessel full penetration pressure-retaining Examination Category B-A and B-D welds in the fifth inservice inspection interval in the fall of 2028, before the end of the interval on April 30, 2029. The dates in the latest implementation plan, PWROG Letter OG-10-238 (Reference 2), reflect no implementation of the extended inservice inspection interval for North Anna Unit 1; therefore, the proposed inspection date for North Anna Unit 1 is a deviation from the schedule presented in Reference 2.

In accordance with 10 CFR 50.55a(z)(1), an alternate inspection interval is requested on the basis that the current interval can be revised with negligible change in risk by satisfying the risk criteria specified in Regulatory Guide 1.174 (Reference 3).

The methodology used to conduct this analysis is based on that defined in the study WCAP-16168-NP-A, Revision 3, "Risk-Informed Extension of the Reactor Vessel Inservice Inspection Interval" (Reference 4). This study focuses on risk assessments of materials within the beltline region of the RV wall. The results of the calculations for North Anna Unit 1 were compared to those obtained from the Westinghouse pilot plant evaluated in WCAP-16168-NP-A. Appendix A of the WCAP identifies the parameters to be compared. Demonstrating that the parameters for North Anna Unit

1 are bounded by the results of the Westinghouse pilot plant qualifies North Anna Unit 1 for an ISI interval extension. Table 1 below lists the critical parameters investigated in the WCAP and compares the results of the Westinghouse pilot plant to those of North Anna Unit 1. Tables 2 and 3 provide additional information that was requested by the NRC and included in Reference 4, Appendix A.

<b>Table 1: Critical Parameters for the Application of Bounding Analysis for North Anna Unit 1</b>			
<b>Parameter</b>	<b>Pilot Plant Basis</b>	<b>Plant-Specific Basis</b>	<b>Additional Evaluation Required?</b>
Dominant Pressurized Thermal Shock (PTS) Transients in the NRC PTS Risk Study are Applicable	NRC PTS Risk Study (Reference 5)	PTS Generalization Study (Reference 6)	No
Through-Wall Cracking Frequency (TWCF)	1.76E-08 Events per year (Reference 4)	1.56E-11 Events per year (Calculated per Reference 4)	No
Frequency and Severity of Design Basis Transients	7 heatup/cooldown cycles per year (Reference 4)	Bounded by 7 heatup/cooldown cycles per year	No
Cladding Layers (Single/Multiple)	Single Layer (Reference 4)	Single Layer	No

Table 2 provides a summary of the latest reactor vessel inspection for North Anna Unit 1 and an evaluation of the recorded indications. This information confirms that satisfactory examinations have been performed on the North Anna Unit 1 reactor vessel.

Inspection methodology:	AREVA NP, Inc. performed the latest ultrasonic examinations of the North Anna Unit 1 reactor vessel welds in March 2009, during the 1R20 outage. The ultrasonic examinations were performed using examination procedures and personnel qualified by demonstration in accordance with the requirements of Appendix VIII of the ASME Code, Section XI, 1998 Edition, with Editions and Addenda through 2000, as modified by the Performance Demonstration Initiative (PDI) program. Examinations of Category B-A and B-D welds were performed to ASME Section XI, Appendix VIII 1989 Edition with no Addenda. Future inservice inspections will be performed to ASME Section XI, Appendix VIII requirements.
Number of past inspections:	Three complete 10-Year inservice inspections have been performed.
Number of indications found:	Four indications were identified in the beltline region during the most recently completed inservice inspection. All four subsurface indications are located in the intermediate shell to lower shell circumferential weld seam (Table 3, Item 5). All four indications are acceptable per Table IWB-3510-1 of Section XI of the ASME Code. None of these indications are within the inner 1/10 <sup>th</sup> or 1 inch of the reactor vessel thickness; therefore, they are inherently acceptable per the requirements of the Alternate PTS Rule, 10 CFR 50.61a (Reference 7).
Proposed inspection schedule for balance of plant life:	The fourth inservice inspection currently is scheduled for spring 2018. With implementation of the extended inservice inspection interval, this inservice inspection will be performed in the fall of 2028, before the end of the interval on April 30, 2029. The dates in the latest implementation plan, PWROG Letter OG-10-238 (Reference 2), reflect no implementation of the extended inservice inspection interval for North Anna Unit 1; therefore, this is a deviation from the inspection schedule outlined in the Reference 2.

Table 3 summarizes the inputs and outputs for the calculation of through-wall cracking frequency (TWCF).

Table 3: Details of TWCF Calculation for North Anna Unit 1 at 54 Effective Full Power Years									
Inputs									
Reactor Coolant System Temperature, T <sub>c</sub> [°F]:			N/A		T <sub>wall</sub> [inches]:			7.833	
No.	Region and Component Description	Material Heat No.	Cu [wt%] (a)	Ni [wt%] (a)	R.G. 1.99 Pos. (a)	CF [°F] (a)	RT <sub>NDT(u)</sub> [°F] (a)	Fluence [10 <sup>19</sup> Neutron/cm <sup>2</sup> E > 1.0 MeV] (b)	
1	Nozzle Shell (NS) Forging	990286/295213	0.160	0.740	1.1	121.5	6	0.230	
2	Intermediate Shell (IS) Forging	990311/298244	0.120	0.820	1.1	86.0	17	5.39	
3	Lower Shell (LS) Forging	990400/292332	0.156	0.817	2.1	82.9	38	5.48	
4a	NS to IS Circ. Weld Seam (OD 94%)	25295	0.352	0.125	2.1	144.2	0	0.266	
4b	NS to IS Circ. Weld Seam (ID 6%)	4278	0.120	0.110	2.1	92.4	0	0.266	
5	IS to LS Circ. Weld Seam	25531	0.098	0.124	1.1	56.2	19	5.36	
Outputs									
Methodology Used to Calculate ΔT <sub>30</sub> :				Regulatory Guide 1.99, Revision 2 <sup>(c)</sup>					
Description	Controlling Material Region No. (From Above)	RT <sub>MAX-XX</sub> [°R]	Fluence [10 <sup>19</sup> Neutron/cm <sup>2</sup> , E > 1.0 MeV]	FF (Fluence Factor)	ΔT <sub>30</sub> [°F]	TWCF <sub>95-XX</sub>			
Limiting Forging (lower shell) - FO	3	615.39	5.48	1.4200	117.72	6.23E-12			
Limiting Circumferential Weld (lower shell forging) - CW	3	615.04	5.36	1.4158	117.37	0.00E+00			
<b>TWCF<sub>95-TOTAL</sub>(α<sub>FO</sub>·TWCF<sub>95-FO</sub> + α<sub>CW</sub>·TWCF<sub>95-CW</sub>):</b>							<b>1.56E-11</b>		

Notes:

- (a) Material property inputs per Reference 8
- (b) Fluence inputs per Reference 9
- (c) Reference 10



## **6. DURATION OF PROPOSED ALTERNATIVE**

This request is applicable to the North Anna Unit 1 inservice inspection program for the fourth and fifth 10-year inspection intervals.

## **7. PRECEDENTS**

- “Surry Power Station Units 1 and 2 – Relief Implementing Extended Reactor Vessel Inspection Interval (TAC Nos. ME8573 and ME8574),” dated April 30, 2013, Agencywide Document Access and Management System (ADAMS) Accession Number ML13106A140.
- “Vogtle Electric Generating Plant, Units 1 and 2 – Request for Alternatives VEGP-ISI-ALT-05 and VEGP-ISI-ALT-06 (TAC Nos. MF2596 and MF2597),” dated March 20, 2014, ADAMS Accession Number ML14030A570.
- “Catawba Nuclear Station Units 1 and 2: Proposed Relief Request 13-CN-003, Request for Alternative to the Requirement of IWB-2500, Table IWB-2500-1, Category B-A and Category B-D for Reactor Pressure Vessel Welds (TAC Nos. MF1922 and MF1923),” dated March 26, 2014, ADAMS Accession Number ML14079A546.
- “Sequoyah Nuclear Plant, Units 1 and 2 – Requests for Alternatives 13-ISI-1 and 13-ISI-2 to Extend the Reactor Vessel Weld Inservice Inspection Interval (TAC Nos. MF2900 and MF2901),” dated August 1, 2014, ADAMS Accession Number ML14188B920.
- “Byron Station, Unit No. 1 – Relief from Requirements of the ASME Code to Extend the Reactor Vessel Inservice Inspection Interval (TAC No. MF3596),” dated December 10, 2014, ADAMS Accession Number ML14303A506.
- “Wolf Creek Generating Station – Request for Relief Nos. I3R-08 and I3R-09 for the Third 10-Year Inservice Inspection Program Interval (TAC Nos. MF3321 and MF3322),” dated December 10, 2014, ADAMS Accession Number ML14321A864.
- “Callaway Plant, Unit 1 – Request for Relief I3R-17, Alternative to ASME Code Requirements Which Extends the Reactor Vessel Inspection Interval from 10 to 20 Years (TAC No. MF3876),” dated February 10, 2015, ADAMS Accession Number ML15035A148.

## **8. REFERENCES**

1. ASME Boiler and Pressure Vessel Code, Section XI, 2004 Edition with No Addenda, ASME International.
2. PWROG Letter OG-10-238, "Revision to the Revised Plan for Plant Specific Implementation of Extended Inservice Inspection Interval per WCAP-16168-NP, Revision 1, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval." PA-MS-0120," July 12, 2010, ADAMS Accession Number ML11153A033.
3. NRC Regulatory Guide 1.174, Revision 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," U.S. Nuclear Regulatory Commission, November 2002, ADAMS Accession No. ML023240437.
4. Westinghouse Report WCAP-16168-NP-A, Revision 3, "Risk-Informed Extension of the Reactor Vessel In-service Inspection Interval," October 2011, ADAMS Accession Number ML113060207.
5. NUREG-1874, "Recommended Screening Limits for Pressurized Thermal Shock (PTS)," U.S. Nuclear Regulatory Commission, March 2010.
6. NRC Letter Report, "Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants," U.S. Nuclear Regulatory Commission, December 14, 2004, ADAMS Accession Number ML042880482.
7. Code of Federal Regulations, 10 CFR Part 50.61a, "Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," U.S. Nuclear Regulatory Commission, Washington D. C., Federal Register, Volume 75, No. 1, dated January 4, 2010 and No. 22 with corrections to part (g) dated February 3, 2010, March 8, 2010, and November 26, 2010.
8. Dominion Letter to the U.S. NRC, "Virginia Electric and Power Company (Dominion) North Anna Power Station Units 1 and 2 Update to Reactor Vessel Integrity Database to Reflect License Renewal Period," Docket Nos. 50-338 and 50-339, December 13, 2005, ADAMS Accession No. ML053480358.
9. Westinghouse Report WCAP-18015-NP, Revision 0, "Extended Beltline Pressure Vessel Fluence Evaluations Applicable to North Anna 1 & 2," November 2015.
10. NRC Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," U.S. Nuclear Regulatory Commission, May 1988, ADAMS Accession No. ML003740284.

**Attachment 2**

**Proposed Inservice Inspection Alternative N2-I4-NDE-003**

**In Accordance with 10 CFR 50.55a(z)(1)**

**Virginia Electric and Power Company (Dominion)**

## North Anna Power Station Unit 2

### REQUEST FOR ALTERNATIVE N2-I4-NDE-003 REACTOR VESSEL WELD EXAMINATION EXTENSION

*Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1)*

*-Alternative Provides Acceptable Level of Quality and Safety*

#### 1. ASME CODE COMPONENTS AFFECTED

The affected component is the North Anna Unit 2 reactor vessel (RV); specifically, the following American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI (Reference 1) examination categories and item numbers covering examinations of the RV. These examination categories and item numbers are from IWB-2500 and Table IWB-2500-1 of the ASME BPV, Code Section XI.

Category B-A welds are defined as "Pressure Retaining Welds in Reactor Vessel"  
Category B-D welds are defined as "Full Penetration Welded Nozzles in Vessels"

#### **Examination**

<b>Category</b>	<b>Item No.</b>	<b>Description</b>
B-A	B1.10	Shell Welds
B-A	B1.11	Circumferential Shell Welds
B-A	B1.20	Head Welds
B-A	B1.21	Circumferential Head Welds
B-A	B1.22	Meridional Head Welds
B-A	B1.30	Shell-to-Flange Weld
B-A	B1.40	Head-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inside Radius Section

(Throughout this request the above examination categories are referred to as "the subject examinations" and the ASME BPV Code, Section XI, is referred to as "the Code.")

#### 2. APPLICABLE CODE EDITION AND ADDENDA

North Anna Power Station Unit 2 (NAPS 2) applicable Code for the fourth 10-year inservice inspection (ISI) interval and the ISI program is the 2004 Edition of Section XI with no Addenda (Reference 1). NAPS 2 fourth interval started December 14, 2010 and ends December 13, 2020.

### **3. APPLICABLE CODE REQUIREMENTS**

IWB-2412, Inspection Program B, requires volumetric examination of essentially 100% of reactor vessel pressure-retaining welds identified in Table IWB-2500-1 once each 10-year interval. The North Anna Unit 2 fourth 10-year inservice inspection (ISI) interval is scheduled to end on December 13, 2020. The applicable Code for the fifth 10-year ISI interval will be selected in accordance with the requirements of 10 CFR 50.55a.

### **4. REASON FOR REQUEST**

An alternative is requested from the requirement of IWB-2412, Inspection Program B, that volumetric examination of essentially 100% of reactor vessel pressure-retaining Examination Category B-A and B-D welds be performed once each 10-year interval. Extension of the interval between examinations of Category B-A and B-D welds from 10 years to up to 20 years will result in a reduction in man-rem exposure and examination costs.

### **5. PROPOSED ALTERNATIVES AND BASIS FOR USE**

Dominion proposes not to perform the ASME Code required volumetric examination of the North Anna Unit 2 reactor vessel full penetration pressure-retaining Examination Category B-A and B-D welds for the fourth inservice inspection, currently scheduled for fall 2020. Dominion will perform the fourth ASME Code required volumetric examination of the North Anna Unit 2 reactor vessel full penetration pressure-retaining Examination Category B-A and B-D welds in the fifth inservice inspection interval in the fall of 2029, before the end of the interval on December 13, 2030. The dates in the latest implementation plan, PWROG Letter OG-10-238 (Reference 2), reflect no implementation of the extended inservice inspection interval for North Anna Unit 2; therefore, the proposed inspection date for North Anna Unit 2 is a deviation from the schedule presented in Reference 2.

In accordance with 10 CFR 50.55a(z)(1), an alternate inspection interval is requested on the basis that the current interval can be revised with negligible change in risk by satisfying the risk criteria specified in Regulatory Guide 1.174 (Reference 3).

The methodology used to conduct this analysis is based on that defined in the study WCAP-16168-NP-A, Revision 3, "Risk-Informed Extension of the Reactor Vessel In-service Inspection Interval" (Reference 4). This study focuses on risk assessments of materials within the beltline region of the RV wall. The results of the calculations for North Anna Unit 2 were compared to those obtained from the Westinghouse pilot plant evaluated in WCAP-16168-NP-A. Appendix A of the WCAP identifies the parameters to be compared. Demonstrating that the parameters for North Anna Unit

2 are bounded by the results of the Westinghouse pilot plant qualifies North Anna Unit 2 for an ISI interval extension. Table 1 below lists the critical parameters investigated in the WCAP and compares the results of the Westinghouse pilot plant to those of North Anna Unit 2. Tables 2 and 3 provide additional information that was requested by the NRC and included in Reference 4, Appendix A.

<b>Table 1: Critical Parameters for the Application of Bounding Analysis for North Anna Unit 2</b>			
<b>Parameter</b>	<b>Pilot Plant Basis</b>	<b>Plant-Specific Basis</b>	<b>Additional Evaluation Required?</b>
Dominant Pressurized Thermal Shock (PTS) Transients in the NRC PTS Risk Study are Applicable	NRC PTS Risk Study (Reference 5)	PTS Generalization Study (Reference 6)	No
Through-Wall Cracking Frequency (TWCF)	1.76E-08 Events per year (Reference 4)	1.97E-10 Events per year (Calculated per Reference 4)	No
Frequency and Severity of Design Basis Transients	7 heatup/cooldown cycles per year (Reference 4)	Bounded by 7 heatup/cooldown cycles per year	No
Cladding Layers (Single/Multiple)	Single Layer (Reference 4)	Single Layer	No

Table 2 provides a summary of the latest reactor vessel inspection for North Anna Unit 2 and an evaluation of the recorded indications. This information confirms that satisfactory examinations have been performed on the North Anna Unit 2 reactor vessel.

Inspection methodology:	AREVA NP, Inc. performed the latest ultrasonic examinations of the North Anna Unit 2 reactor vessel welds in April 2010, during the 2R20 outage. The ultrasonic examinations were performed using examination procedures and personnel qualified by demonstration in accordance with the requirements of Appendix VIII of the ASME Code, Section XI, 1995 Edition, with Editions and Addenda through 1996, as modified by the Performance Demonstration Initiative (PDI) program. Evaluation of recordable indications in Category B-A and B-D welds were performed to ASME Section XI, Appendix VIII 1995 Edition, with Editions and Addenda through 1996 (Reference 1). Future inservice inspections will be performed to ASME Section XI, Appendix VIII requirements.
Number of past inspections:	Three complete 10-Year inservice inspections have been performed.
Number of indications found:	Nineteen indications were identified in the beltline region during the most recently completed inservice inspection. All nineteen subsurface indications are located in intermediate shell to lower shell circumferential weld seam (Table 2-3, Item 5). All nineteen indications are acceptable per Table IWB-3510-1 of Section XI of the ASME Code. None of these indications are within the inner 1/10th or 1 inch of the reactor vessel thickness; therefore, they are inherently acceptable per the requirements of the Alternate PTS Rule, 10 CFR 50.61a (Reference 7).
Proposed inspection schedule for balance of plant life:	The fourth inservice inspection currently is scheduled for fall 2020. With implementation of the extended inservice inspection interval, this inservice inspection will be performed in the fall of 2029, before the end of the interval on December 13, 2030. The dates in the latest implementation plan, PWROG Letter OG-10-238 (Reference 2), reflect no implementation of the extended inservice inspection interval for North Anna Unit 2; therefore, this is a deviation from the inspection schedule outlined in Reference 2.

Table 3 summarizes the inputs and outputs for the calculation of through-wall cracking frequency (TWCF).

Table 3: Details of TWCF Calculation for North Anna Unit 2 at 54 Effective Full Power Years									
Inputs									
Reactor Coolant System Temperature, T <sub>c</sub> [°F]:			N/A		T <sub>wall</sub> [inches]:			7.833	
No.	Region and Component Description	Material Heat No.	Cu [wt%] <sub>(a)</sub>	Ni [wt%] <sub>(a)</sub>	R.G. 1.99 Pos. <sub>(a)</sub>	CF [°F] <sub>(a)</sub>	RT <sub>NDT(u)</sub> [°F] <sub>(a)</sub>	Fluence [10 <sup>19</sup> Neutron/cm <sup>2</sup> E > 1.0 MeV] <sub>(b)</sub>	
1	Nozzle Shell (NS) Forging	990598/291396	0.080	0.770	1.1	51.0	9	0.228	
2	Intermediate Shell (IS) Forging	990496/292424	0.107	0.857	2.1	54.1	75	5.39	
3	Lower Shell (LS) Forging	990533/297355	0.130	0.830	1.1	96.0	56	5.48	
4a	NS to IS Circ. Weld Seam (OD 94%)	4278	0.120	0.110	2.1	92.4	0	0.264	
4b	NS to IS Circ. Weld Seam (ID 6%)	801	0.180	0.110	1.1	87.8	0	0.264	
5	IS to LS Circ. Weld Seam	716126	0.066	0.046	2.1	26.8	-48	5.36	
Outputs									
Methodology Used to Calculate ΔT <sub>30</sub> :				Regulatory Guide 1.99, Revision 2 <sup>(c)</sup>					
Description	Controlling Material Region No. (From Above)	RT <sub>MAX-XX</sub> [°R]	Fluence [10 <sup>19</sup> Neutron/cm <sup>2</sup> , E > 1.0 MeV]	FF (Fluence Factor)	ΔT <sub>30</sub> [°F]	TWCF <sub>95-XX</sub>			
Limiting Forging (lower shell) - FO	3	651.99	5.48	1.4200	136.32	8.44E-11			
Limiting Circumferential Weld (lower shell forging) - CW	3	651.59	5.36	1.4158	135.92	8.22E-15			
<b>TWCF<sub>95-TOTAL</sub>(α<sub>FO</sub>·TWCF<sub>95-FO</sub> + α<sub>CW</sub>·TWCF<sub>95-CW</sub>):</b>							<b>1.97E-10</b>		

Notes:

- (a) Material property inputs per Reference 8
- (b) Fluence inputs per Reference 9
- (c) Reference 10



## **6. DURATION OF PROPOSED ALTERNATIVE**

This request is applicable to the North Anna Unit 2 inservice inspection program for the fourth and fifth 10-year inspection intervals.

## **7. PRECEDENTS**

- "Surry Power Station Units 1 and 2 – Relief Implementing Extended Reactor Vessel Inspection Interval (TAC Nos. ME8573 and ME8574)," dated April 30, 2013, Agencywide Document Access and Management System (ADAMS) Accession Number ML13106A140.
- "Vogtle Electric Generating Plant, Units 1 and 2 – Request for Alternatives VEGP-ISI-ALT-05 and VEGP-ISI-ALT-06 (TAC Nos. MF2596 and MF2597)," dated March 20, 2014, ADAMS Accession Number ML14030A570.
- "Catawba Nuclear Station Units 1 and 2: Proposed Relief Request 13-CN-003, Request for Alternative to the Requirement of IWB-2500, Table IWB-2500-1, Category B-A and Category B-D for Reactor Pressure Vessel Welds (TAC Nos. MF1922 and MF1923)," dated March 26, 2014, ADAMS Accession Number ML14079A546.
- "Sequoyah Nuclear Plant, Units 1 and 2 – Requests for Alternatives 13-ISI-1 and 13-ISI-2 to Extend the Reactor Vessel Weld Inservice Inspection Interval (TAC Nos. MF2900 and MF2901)," dated August 1, 2014, ADAMS Accession Number ML14188B920.
- "Byron Station, Unit No. 1 – Relief from Requirements of the ASME Code to Extend the Reactor Vessel Inservice Inspection Interval (TAC No. MF3596)," dated December 10, 2014, ADAMS Accession Number ML14303A506.
- "Wolf Creek Generating Station – Request for Relief Nos. I3R-08 and I3R-09 for the Third 10-Year Inservice Inspection Program Interval (TAC Nos. MF3321 and MF3322)," dated December 10, 2014, ADAMS Accession Number ML14321A864.
- "Callaway Plant, Unit 1 – Request for Relief I3R-17, Alternative to ASME Code Requirements Which Extends the Reactor Vessel Inspection Interval from 10 to 20 Years (TAC No. MF3876)," dated February 10, 2015, ADAMS Accession Number ML15035A148.

## 8. REFERENCES

1. ASME Boiler and Pressure Vessel Code, Section XI, 2004 Edition with No Addenda, ASME International.
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