

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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U. S. Nuclear Regulatory Commission
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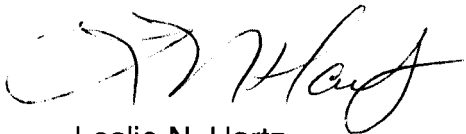
Serial No. 05-129
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VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
REVISED REACTOR VESSEL MATERIALS
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE
NORTH ANNA UNITS 1 AND 2

In accordance with 10 CFR 50 Appendix H, Section III.B.3, Dominion hereby submits for NRC review and approval the proposed reactor vessel material surveillance capsule withdrawal schedules for North Anna Units 1 and 2 and the technical justification supporting those schedules. The proposed schedules were developed to accommodate the 60-year license period for North Anna Units 1 and 2 and to satisfy the requirements and guidance of ASTM E-185-82 and the GALL Report (NUREG-1801) for surveillance capsule withdrawal and testing. The revised reactor vessel materials surveillance capsule withdrawal schedules and technical justification are provided as an attachment.

If you have any questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,



Leslie N. Hartz
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Attachment

Commitments made in this letter: None

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Attachment

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**REVISED REACTOR VESSEL MATERIALS
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE
NORTH ANNA UNITS 1 AND 2**

**Virginia Electric and Power Company
(Dominion)
North Anna Units 1 and 2**

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1.0 Introduction

Virginia Electric and Power Company (Dominion) proposes changes to the reactor vessel materials surveillance capsule withdrawal schedules for North Anna Units 1 and 2. The reactor vessel surveillance program was originally developed under ASTM E-185-73 and the current reactor vessel surveillance capsule withdrawal schedules were developed under ASTM E-185-82 (References 1 and 2). The current reactor vessel materials surveillance capsule withdrawal schedules for the North Anna reactor vessels are contained in the North Anna UFSAR. The reactor vessel materials surveillance capsule withdrawal schedules were developed and approved by the NRC prior to the renewal of the operating licenses at North Anna (References 1 and 2). Dominion provided the NRC with the submittals supporting license renewal for North Anna Units 1 and 2 (References 3 and 4). The NRC approved the renewed licenses for North Anna (Reference 5). The proposed revised capsule withdrawal schedules for North Anna incorporate the renewed license period (i.e., 50.3 EFPY for North Anna Unit 1 and 52.3 EFPY for North Anna Unit 2) as well as the requirements of ASTM E-185-82 (Reference 6) and the recommendations of the Generic Aging Lessons Learned (GALL) Report (Reference 7).

2.0 Background

10 CFR 50 Appendix H defines the requirements for reactor vessel materials surveillance programs. Dominion's compliance with the requirements of Appendix H is documented for North Anna Units 1 and 2 in References 8 and 9, respectively. Appendix H states that the purpose of the materials surveillance program is to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors resulting from exposure of these materials to neutron irradiation and the thermal environment. Fracture toughness data are obtained from material specimens exposed in surveillance capsules, which are withdrawn periodically from the reactor vessel. These data are used as described in Appendix G to 10 CFR 50.

Dominion has confirmed that the highest predicted shift for North Anna Unit 1 materials is 123.3°F, and the highest shift for Unit 2 is 137.7°F. Because these values are greater than 100°F and less than 200°F, North Anna Units 1 and 2 continue to qualify for a four-capsule surveillance program as described in ASTM E-185-82 (Reference 6). Three capsules have already been withdrawn and analyzed from each unit. The capsule withdrawals for both units were performed in a timeframe that was in compliance with Table 1 of ASTM E-185-82. For both North Anna Units 1 and 2, a fourth surveillance capsule must be withdrawn to satisfy the requirements of Table 1 of ASTM E-185-82. ASTM E-185-82 requires that the fluences of the fourth capsules must not be less than once or greater than twice the peak EOL vessel fluence.

In addition to the requirements provided in ASTM E-185-82, the GALL Report, Section XI.M31, "Reactor Vessel Surveillance," provides additional guidance regarding the withdrawal and testing of surveillance capsules for reactors that

operate under a renewed license (i.e., 60-year license). Both Item 5 and Item 6 from Section XI.M31 were considered in developing revised surveillance capsule withdrawal schedules for North Anna Units 1 and 2.

Item 5 applies to capsules with fluences that will not reach 60-year fluence at the end of 40 years operation. Item 5 recommends that a capsule be withdrawn during the period of extended operation (i.e., between 40 and 60 years operation).

Item 6 applies to capsules with fluences exceeding the 60-year fluence at the end of 40 years operation. In addition, Item 6 requires that the capsule removed and tested to have a fluence that does not significantly exceed the vessel fluence at an equivalent of 60 years of operation. In addition, Item 6 allows for the irradiation of standby capsules in order to support potential additional license renewal efforts (e.g., 80-year operation).

3.0 Proposed Changes

Changes to the North Anna Units 1 and 2 reactor vessel materials surveillance capsule withdrawal schedule include:

- (a) The fluences used in the development of the revised surveillance capsule withdrawal schedules were developed using the NRC approved methodology of topical report VEP-NAF-3-A (Reference 10). Note that the fluence estimates are unchanged from those that support the current material property basis (e.g., Reactor Vessel Integrity Database (RVID)).
- (b) In the North Anna Unit 2 surveillance capsule withdrawal schedule, Capsule Z has been designated as the active fourth capsule instead of Capsule X.
- (c) The estimated dates for the removal of the active fourth capsules have been revised to 2030 and 2029 for North Anna Units 1 and 2, respectively. These dates reflect the 60-year license period for North Anna Units 1 and 2 while satisfying the requirements and guidance of ASTM E-185-82 and the GALL Report for surveillance capsule withdrawal and testing.

4.0 Technical Evaluation

Section III.B.3 of 10 CFR 50 Appendix H requires a proposed surveillance capsule withdrawal schedule and its technical justification to be submitted to the NRC for review and approval prior to implementation. The evaluation that follows provides the technical justification for the proposed surveillance capsule withdrawal schedules.

4.1 Use of Dominion Topical Report VEP-NAF-3-A for Fluence Values

The fluence values used in the proposed surveillance capsule withdrawal schedules were developed using the methodology given in VEP-NAF-3-A.

VEP-NAF-3-A has been reviewed and approved by the NRC for use at North Anna Units 1 and 2.

The lead factors given in the revised surveillance capsule withdrawal schedules (Appendix A), which are primarily functions of vessel geometry and thermal hydraulic operating conditions, are unchanged from those of the current schedules described in References 1 and 2.

4.2 Designation of Capsule Z as the Active Fourth Capsule for North Anna Unit 2 Surveillance Program Schedule

The current surveillance capsule withdrawal schedules for North Anna Units 1 and 2 designate capsules Z and X as the active fourth capsules for withdrawal and testing in North Anna Units 1 and 2, respectively. Capsule X in North Anna Unit 2 will reach the 60-year fluence prior to the end of 40 years operation. However, capsule X is the only surveillance capsule that has been in a high lead factor location throughout the life of North Anna Unit 2. Withdrawal of this capsule at a 60-year fluence will prevent the accumulation of larger fluences that could be available to support potential additional life extension efforts. To ensure that the ASTM E-185-82 requirements and the GALL Report guidance are met and to ensure that capsule X is available to support potential additional life extension efforts, capsule X is designated as a standby capsule in North Anna Unit 2 and capsule Z is designated as the fourth active capsule in North Anna Unit 2 to be withdrawn and tested. Capsules Z will reach their 60-year fluence prior to the end of the 60-year license period and therefore meet the requirements of ASTM E-185-82 for North Anna Units 1 and 2.

4.3 Revised Dates for the Removal of the Fourth Surveillance Capsules for North Anna Units 1 and 2

According to the current capsule withdrawal schedules for North Anna Units 1 and 2, Unit 1 has scheduled capsule Z for withdrawal in 2018 and Unit 2 has scheduled capsule X for withdrawal in 2020. However, these current schedules are based upon 40-year operation. The dates for capsule withdrawal for North Anna Units 1 and 2 must be changed in order to ensure that 60-year operation is adequately bounded by the withdrawal and testing of the fourth capsule in each North Anna unit.

As described in Section 4.2, capsules Z are designated as the fourth capsules in North Anna Units 1 and 2. Withdrawal of capsule Z in year 2030 for North Anna Unit 1 and year 2029 for North Anna Unit 2 will provide data that bounds the expected EOL fluence for 60-year operation. At the proposed revised removal dates, capsules Z in each North Anna Unit will have experienced a fluence of at least once but not greater than twice the peak EOL vessel fluence in accordance with the requirements of ASTM E-185-82. In addition, the selected dates for testing and withdrawal of capsules Z in North Anna Units 1 and 2 ensures that the capsule fluences do not significantly exceed the vessel fluence at an equivalent of 60 years of operation per the guidance of the GALL Report.

5.0 UFSAR Sections

After NRC approval of the withdrawal schedule, the affected sections of the North Anna Units 1 and 2 UFSAR will need to be revised to support implementation of the revised surveillance capsule withdrawal schedules.

6.0 Conclusions

Revised reactor vessel materials surveillance capsule withdrawal schedules have been developed for North Anna Units 1 and 2 (Appendix A). These schedules meet the requirements of 10 CFR 50 Appendix H, ASTM E-185-82, and the guidance of the GALL Report. The proposed revised surveillance capsule schedules will ensure that the North Anna Units 1 and 2 reactor vessel material surveillance programs will continue to meet the applicable regulatory requirements through the license period (i.e., 60-year operation).

7.0 References

1. Letter from J. P. O'Hanlon to USNRC, "Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, Reactor Vessel Surveillance Capsule Withdrawal Schedules," Serial No. 98 -646, dated December 17, 1998.
2. Letter from USNRC to J. P. O'Hanlon, "North Anna Power Station Units 1 and 2, Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule (TAC NOS. MA4476, and MA4477," Serial No. 99-446, August 13, 1999.
3. Letter from D. A. Christian to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, License Renewal Applications - Submittal," Serial No. 01-282, dated May 29, 2001.
4. Letter from L. N. Hartz to USNRC, "Virginia Electric and Power Company (Dominion), Surry and North Anna Power Stations Units 1 and 2, Response to Request for Supplemental Information License Renewal Applications," Serial No. 02-601, dated October 15, 2002.
5. Letter from USNRC to D. A. Christian, "License Renewal Safety Evaluation Report for North Anna, Units 1 and 2, and Surry, Units 1 And 2", Serial No. 02-709, November 5, 2002.
6. ASTM E-185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982.
7. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001.
8. WCAP-8771, "North Anna Unit 1 Reactor Vessel Radiation Surveillance Program," dated September 1976.
9. WCAP-8772, "North Anna Unit 2 Reactor Vessel Radiation Surveillance Program," dated November 1976.
10. VEP-NAF-3-A, "Reactor Vessel Fluence Analysis Methodology," April 1999.

APPENDIX A

Revised Reactor Vessel Materials Surveillance Capsule
Withdrawal Schedules for North Anna Units 1 and 2

Table A-1: REVISED Surveillance Capsule Withdrawal Schedule^a for North Anna Unit 1

Capsule Identification.	Capsule Location ^b	Lead Factor ^c	Capsule Status ^d	Withdrawal EFPY/Year	Insert EFPY/Year	Est. Capsule Fluence (x10 ¹⁹) ^e
V	165°	1.6	Active	1.1/1979	NA	0.263
U	65°	1.0	Active	5.9/1987	NA	0.872
W	245°	1.03	Active	14.8/1998	NA	2.052
Z	305°	0.69	Active ^f	16.1/2000	NA	1.48
Z	165°	1.6	Active ^f	NA	16.1/2000	1.48
Z	165°	1.6	Active ^f	44.5/2030 (estimated)	NA	6.49
T	55°	0.69	Standby ^g	16.1/2000	NA	1.48
T	245°	1.03	Standby ^g	NA	16.1/2000	1.48
T	245°	1.03	Standby ^g	NA	NA	5.33 (50.3 EFPY)
Y	295°	1.03	Standby ^g	NA	NA	6.08 (50.3 EFPY)
S	45°	0.55	Standby ^g	NA	NA	3.25 (50.3 EFPY)
X	285°	1.6	Standby ^{f,h}	NA	NA	9.44 (50.3 EFPY)

- a. Withdrawal schedule meets requirements of ASTM E-185-82, *Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels*, dated July 1, 1982. Schedule established by Reference 10 (Letter from NRC as required per 10 CFR 50 App H).
- b. See Figure 5.4-5 for original capsule installation locations.
- c. *Lead Factor* is defined in ASTM E-185-82 as the ratio of the neutron flux density at the location of the specimens in a surveillance capsule to the neutron flux density at the reactor pressure vessel inside surface at the peak fluence location.
- d. Capsules required to satisfy the requirements of ASTM E-185-82 during the original license period are designated *Active*. Capsules not required by ASTM E-185-82, but which are maintained for contingencies, including further license renewal, are designated *Standby*.
- e. Surveillance capsule neutron fluence estimates based on fluence analysis methodology presented in VEP-NAF-3-A, *Reactor Vessel Fluence Analysis Methodology*, dated April 1999. Based on the assumption of a 90% capacity factor for cycles beyond Cycle 10, 50.3 EFPY corresponds to the estimated cumulative core burnup at the end of the 60-year license period.
- f. Capsule X may be withdrawn at 44.5 EFPY in lieu of Capsule Z to satisfy ASTM E-185-82 fourth capsule requirement for the license period.
- g. Capsules T, Y, and S are available to satisfy potential fluence monitoring requirements during the 20-year license renewal period.
- h. Capsule X may be withdrawn at EOL to provide material properties data at a fluence, which exceeds that, expected to be achieved at the end of the 20-year license renewal period.

Table A-2: Revised Surveillance Capsule Withdrawal Schedule^a for North Anna Unit 2

Capsule Identification	Capsule Location ^b	Lead Factor ^c	Capsule Status ^d	Withdrawal EFPY/Year	Insert EFPY/Year	Est. Capsule Fluence (x10 ¹⁹) ^e
V	165°	1.66	Active	1.0/1982	NA	0.246
U	65°	1.19	Active	6.3/1989	NA	0.980
W	245°	1.19	Active	15.3/1999	NA	2.092
Z	305°	0.81	Standby ^f	15.3/1999	NA	1.54
Z	165°	1.66	Standby ^f	NA	15.3/1999	1.54
Z	165°	1.66	Active ^g	42.8/2029 (estimated)	NA	6.50
T	55°	0.81	Standby ^f	15.3/1999	NA	1.54
T	65°	1.19	Standby ^f	NA	15.3/1999	1.54
T	65°	1.19	Standby ^f	NA	NA	6.31 (52.3 EFPY)
Y	295°	1.19	Standby ^f	NA	NA	7.03 (52.3 EFPY)
S	45°	0.65	Standby ^f	NA	NA	3.84 (52.3 EFPY)
X	285°	1.72	Standby ^{f,h}	NA	NA	10.17 (52.3 EFPY)

- a. Withdrawal schedule meets requirements of ASTM E-185-82, *Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels*, dated July 1, 1982. Schedule established by Reference 10 (Letter from NRC as required per 10 CFR 50 App H).
- b. See Figure 5.4-5 for original capsule installation locations.
- c. *Lead Factor* is defined in ASTM E-185-82 as the ratio of the neutron flux density at the location of the specimens in a surveillance capsule to the neutron flux density at the reactor pressure vessel inside surface at the peak fluence location.
- d. Capsules required to satisfy the requirements of ASTM E-185-82 during the original license period are designated *Active*. Capsules not required by ASTM E-185-82, but which are maintained for contingencies, including further license renewal, are designated *Standby*.
- e. Surveillance capsule neutron fluence estimates based on fluence analysis methodology presented in VEP-NAF-3-A, *Reactor Vessel Fluence Analysis Methodology*, dated April 1999. Based on the assumption of a 90% capacity factor for cycles beyond Cycle 10, 52.3 EFPY corresponds to the estimated cumulative core burnup at the end of the 60-year license period.
- f. Capsules T, Y, S, and X are available to satisfy potential fluence monitoring requirements during the 20-year license renewal period. Capsule X may be withdrawn at 42.8 EFPY in lieu of Capsule Z to satisfy ASTM E-185-82 fourth capsule requirement for the license period.
- g. Withdrawal of Capsule Z at EOL satisfies ASTM E-185-82 requirement for EOL capsule, and provides material properties data at a fluence which exceeds that expected to be achieved at the end of the 20-year license renewal period.
- h. Capsule X may be withdrawn at EOL to provide material properties data at a fluence which exceeds that expected to be achieved at the end of the 20-year license renewal period.