March 15, 2006

Mr. David A. Christian
Senior Vice 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 NOS. 1 AND 2 (NORTH ANNA 1 AND 2) - APPROVAL OF PROPOSED REACTOR VESSEL MATERIAL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (TAC NOS. MC6412 AND MC6413)

Dear Mr. Christian:

By letter dated March 15, 2005, as supplemented by letter dated December 9, 2005, Virginia Electric and Power Company submitted proposed reactor vessel material surveillance capsule withdrawal schedules for the Nuclear Regulatory Commission (NRC) staff's review and approval. The proposed schedules were developed to accommodate the 60-year licensing period for North Anna 1 and 2 using the guidance of the American Society for Testing and Materials (ASTM), E-185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," and NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

Our review is contained in the enclosed safety evaluation. The NRC staff has concluded that the proposed surveillance capsule withdrawal schedules for North Anna 1 and 2 are in accordance with Title 10 of the *Code of Federal Regulations*, Part 50, Appendix H and the recommendations of ASTM E-185-82.

Sincerely,

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated March 15, 2005, as supplemented by letter dated December 9, 2005, Virginia Electric and Power Company (VEPCO) submitted proposed reactor pressure vessel (RPV) material surveillance capsule withdrawal schedules for the Nuclear Regulatory Commission (NRC) staff's review and approval in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix H, Section III.B.3. The proposed schedules were developed to accommodate the 60-year licensing period at North Anna Power Station, Unit Nos. 1 and 2 (North Anna 1 and 2) using the guidance of the American Society for Testing and Materials (ASTM), E-185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," and NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

2.0 REGULATORY EVALUATION

The surveillance program requirements in Appendix H to 10 CFR Part 50, "Reactor Vessel Material Surveillance Program Requirements," were established to monitor the radiation-induced changes in the mechanical and impact properties of the RPV materials. Appendix H to 10 CFR Part 50 requires licensees to monitor changes in the fracture toughness properties of ferritic materials in the RPV beltline region of light-water nuclear power reactors. Appendix H to 10 CFR Part 50 states that the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of ASTM E-185 that is current on the issue date of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), to which the RPV was purchased. Later editions of ASTM E-185-82 may be used including those editions through 1982. NUREG-1801 provides additional guidance for the surveillance program for the 60-year extended period of operation.

3.0 TECHNICAL EVALUATION

3.1 Evaluation Criteria of ASTM E-185-82

For North Anna 1 and 2, VEPCO is using the requirements of ASTM E-185-82 as its basis for meeting the RPV surveillance capsule withdrawal requirements of 10 CFR Part 50, Appendix H. Table 1 of ASTM E-185-82 requires that either a minimum of three, four, or five

surveillance capsules be removed from each of the vessels, as based on the limiting amount of reference nil-ductility temperature shift (ΔRT_{NDT}) that is projected to occur at the clad-vessel interface location of the RPV at the end-of-licensed plant life (EOL). ASTM E-185-82 establishes the following criteria for determining the minimum number of capsules that are to be removed in accordance with a withdrawal schedule and the number of capsules that are to be tested:

1. For plants with projected ΔRT_{NDT} less than 100 EF (56 EC), three capsules are required to be removed from the RPV and the first two capsules are required to be tested (for dosimetry, tensile-ductility, Charpy-V impact toughness, and alloying chemistry).

2. For plants with projected ΔRT_{NDT} between 100 EF (56 EC) and 200 EF (111 EC), four surveillance capsules are to be removed from the RPV and the first three capsules are required to be tested.

3. For plants with projected ΔRT_{NDT} above 200 EF (111 EC), five surveillance capsules are required to be removed from the RPV and the first four capsules are required to be tested.

For the 60-year extended periods of operation, the North Anna 1 and 2 RPVs have limiting ΔRT_{NDT} values between 100 EF and 200 EF (i.e., an ΔRT_{NDT} value of 123.3 EF for North Anna 1 and an ΔRT_{NDT} value of 137.7 EF for North Anna 2). The licensee is therefore required, as a minimum, to remove four capsules from each reactor during the 60-year extended periods of operation. The licensee has already withdrawn three out of the four capsules from each reactor and has proposed an appropriate withdrawal schedule for the fourth capsule in each reactor.

The NRC staff notes that there can be up to four standby surveillance capsules for North Anna 1 and 2 that have the potential of being removed for storage. However, there currently is no detailed guidance regarding the treatment of standby capsules that are removed but not tested. Therefore, the NRC staff requested the licensee to provide information on how they intend to ensure that any surveillance capsules removed from the North Anna 1 and 2 RPVs, without the intent to test them, are maintained in a condition that would permit their future use, if necessary. This information concerning the storage of these standby capsules should be included in the North Anna 1 and 2 "Updated Final Safety Analysis Report (UFSAR)." In its letter dated December 9, 2005, VEPCO stated that the following would be included in the applicable section of the North Anna 1 and 2 UFSAR:

> All surveillance capsules placed in storage will be maintained for possible future insertion. If one or more capsules will not be maintained in such a way as to permit future insertion, then the NRC staff will be notified of this change.

The NRC staff concludes that the inclusion of these requirements in the applicable North Anna 1 and 2 UFSAR sections provides the necessary guidance to ensure that any surveillance capsules removed from the North Anna 1 and 2 RPVs, without the intent to test them, are maintained in a condition that would permit their future use, if necessary.

3.2 Changes Proposed to the Withdrawal Schedule for North Anna 1

The licensee's letters of March 15 and December 9, 2005, provide the updated RPV

surveillance capsule withdrawal schedule for North Anna 1. The letters indicate that Capsules V, U, and W were removed from North Anna Unit 1 at 1.1 effective full power years (EFPY), 5.9 EFPY, and 14.8 EFPY, and that the neutron fluences reported for Capsules V, U, and W at the time of withdrawal were 0.263 x 10^{19} n/cm^2 (E > 1.0 MeV), 0.872 x 10^{19} n/cm^2 (E > 1.0 MeV), and 2.052 x 10^{19} n/cm^2 (E > 1.0 MeV), respectively. The proposed withdrawal schedule has the fourth-capsule, Capsule Z, being withdrawn for testing at 44.5 EFPY with an estimated neutron fluence value of 6.49 x 10^{19} n/cm^2 (E > 1.0 MeV). The letters also reported updated lead factors for surveillance Capsules V, U, W, and Z.

The NRC staff compared updated withdrawal data for surveillance Capsules V, U, W, and Z with the criteria of ASTM E-185-82 for a required four-capsule withdrawal schedule. The NRC staff confirmed that the withdrawals were consistent with the criteria in ASTM E-185-82 for the four-capsule withdrawal schedule. It should be noted that the proposed surveillance withdrawal schedule in the licensee's letter dated March 15, 2005, provides an option that Capsule X may be withdrawn at 44.5 EFPY with an estimated neutron fluence value of 8.45 x 10^{19} n/cm^2 (E >1.0 MeV) in lieu of Capsule Z to satisfy the ASTM E-185-82 fourth-capsule requirement for the extended period of operation. The limiting neutron fluence projected for the North Anna 1 RPV is approximately 5.9 x 10^{19} n/cm^2 (E > 1.0 MeV) at its EOL (60-year operating period). Since either Capsule Z or X has a neutron fluence value greater than this, but not greater than twice the EOL fluence value, the NRC staff has determined that the removal of either of these capsules is consistent with the criterion in ASTM E-185-82 for the final required capsule to be withdrawn and tested.

3.3 Changes Proposed to the Withdrawal Schedule for North Anna 2

The licensee's letters of March 15 and December 9, 2005, provide the updated RPV surveillance capsule withdrawal schedule for North Anna 2. The letters indicate that Capsules V, U, and W were removed from North Anna Unit 2 at 1.0 EFPY, 6.3 EFPY, and 15.3 EFPY, and that the neutron fluences reported for Capsules V, U, and W at the time of withdrawal were 0.246 x 10^{19} n/cm^2 (E > 1.0 MeV), 0.980 x 10^{19} n/cm^2 (E > 1.0 MeV), and 2.092 x 10^{19} n/cm^2 (E > 1.0 MeV), respectively. The proposed withdrawal schedule has the fourth-capsule, Capsule Z, being withdrawn for testing at 42.8 EFPY with an estimated neutron fluence value of 6.50 x 10^{19} n/cm^2 (E > 1.0 MeV). The letters also reported updated lead factors for surveillance Capsules V, U, W, and Z.

The NRC staff compared updated withdrawal data for North Anna 2 surveillance Capsules V, U, W, and Z with the criteria of ASTM E-185-82 for a required four-capsule withdrawal schedule. The NRC staff confirmed that the withdrawals were consistent with the criteria in ASTM E-185-82 for the four-capsule withdrawal schedule. It should be noted that the proposed surveillance capsule withdrawal schedule in the licensee's letter dated March 15, 2005, provides an option that Capsule X may be withdrawn at 42.8 EFPY with an estimated neutron fluence value of 8.39 x 10^{19} n/cm^2 (E > 1.0 MeV) in lieu of Capsule Z to satisfy the ASTM E-185-82 fourth-capsule requirement for the extended period of operation. The limiting neutron fluence projected for the North Anna 2 RPV is approximately 5.91 x 10^{19} n/cm^2 (E > 1.0 MeV) at its EOL (60-year operating period). Since either Capsule Z or X has a neutron fluence value greater than this, but not greater than twice the EOL fluence value, the NRC staff has determined that the removal of either of these capsules is consistent with the criterion in ASTM E-185-82 for the final required capsule to be withdrawn and tested.

4.0 CONCLUSION

Based on the NRC's staff's review of VEPCO's submittal, the NRC staff has found that the revised surveillance capsule withdrawal schedules for the North Anna 1 and 2 RPV's satisfy the requirements of ASTM E-185-82. Therefore, the NRC staff concludes that the licensee's modified surveillance capsule withdrawal schedules for North Anna 1 and 2, as provided in the March 15, 2005, letter and as supplemented by the December 9, 2005, letter, are acceptable for implementation and satisfy the requirements of Appendix H to 10 CFR Part 50 for the 60-year extended license period.

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Date: March 15, 2006

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