

June 6, 2005

Mr. Jeffery Archie
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 - ISSUANCE OF
SAFETY EVALUATION ON THE REACTOR VESSEL SURVEILLANCE
PROGRAM SCHEDULE (TAC NO. MC2624)

Dear Mr. Archie:

By letter dated March 5, 2004, South Carolina Electric and Gas Company (SCE&G, the licensee) submitted for Nuclear Regulatory Commission (NRC) staff review and approval, a request to modify the reactor vessel coupon withdrawal schedule for Virgil C. Summer Nuclear Station (VCSNS), which was based on the American Society for Testing and Materials (ASTM) E185-82 recommendations. The purpose of the licensee's submittal was to provide a more effective surveillance capsule withdrawal schedule for VCSNS. Specifically, the licensee proposed the withdrawal schedule to reflect the results from the latest capsule removed and to reflect the license renewal period of 60 years.

The NRC staff has reviewed the SCE&G submittal and concludes that the proposed withdrawal schedule for the capsules mentioned above are in accordance with the recommendations of the ASTM E185-82 and Appendix H to Title 10, *Code of Federal Regulations* (10 CFR) Part 50. The NRC staff has independently verified that the proposed withdrawal schedule for the capsules indicated above for the VCSNS reactor pressure vessel coupon surveillance program complies with the requirements of ASTM E185-82 and Appendix H to 10 CFR Part 50. The NRC staff also concluded that the licensee satisfied the commitment in Section 3.1.2.3.6 of NUREG-1787. The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA/

Robert E. Martin, Senior, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO MODIFY THE REACTOR VESSEL SURVEILLANCE

CAPSULE WITHDRAWAL SCHEDULE

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated March 5, 2004, South Carolina Electric & Gas Company (SCE&G, the licensee) submitted for Nuclear Regulatory Commission (NRC) staff review and approval, a revised withdrawal schedule for the Virgil C. Summer Nuclear Station (VCSNS) reactor vessel material surveillance program, which was based on the American Society for Testing and Materials (ASTM) E185-73 and ASTM E185-82 recommendations. The purpose of the licensee's submittal was to modify the surveillance capsule withdrawal schedule to reflect the renewal license period of 60 years, as required by the NRC Safety Evaluation for SCE&G License Renewal (NUREG-1787).

2.0 REGULATORY EVALUATION

The surveillance program for SCE&G was implemented to monitor the radiation-induced changes in the mechanical and impact properties of the pressure vessel materials. The surveillance program was established in accordance with Appendix H to Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Reactor Vessel Material Surveillance Program Requirements." Appendix H to 10 CFR Part 50 requires licensees to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel 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 E185 that is current on the issue date of the American Society of Mechanical Engineers (ASME) Code to which the reactor vessel was purchased. Later editions of ASTM E185 may be used including those editions through 1982.

3.0 BACKGROUND

The reactor pressure vessel (RPV) surveillance program for the SCE&G was initially determined per ASTM E185-73, which was the edition of the ASTM standard that was in effect on the issue date of Section III of the ASME Boiler and Pressure Vessel Code (1971 through

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summer 1972 Addenda), to which the VCSNS reactor vessel was designed. However, the licensee chose to use a later edition of the ASTM standard (ASTM E185-82) in establishing their surveillance capsule withdrawal schedules for VCSNS. The withdrawal schedule recommended in ASTM E185-82 is for a vessel with a design of 32 effective full power years (EFPYs), which corresponds to 40 years of operation with an 80 percent capacity factor.

The surveillance capsule withdrawal schedule and testing criteria for ASTM E185-82 depend upon the predicted transition temperature shift (ΔRT_{NDT}) at the vessel inside surface. For VCSNS the predicted ΔRT_{NDT} at the vessel inside surface is less than 100 EF at the end of life (EOL); therefore, ASTM E185-82 recommends a three-capsule removal schedule. However, as a conservative measure SCE&G has elected to remain with its five-capsule removal schedule to allow for continued verification of the predicted properties of the reactor vessel and to follow the ASTM E185-82 guidance for a five-capsule schedule.

For a five-capsule removal schedule, ASTM E185-82 recommends that the first capsule shall be withdrawn when the accumulated neutron fluence of the capsule exceeds 5×10^{18} n/cm², or when the highest predicted ΔRT_{NDT} of all encapsulated materials is approximately 28 EC, whichever comes first. The second capsule is recommended to be withdrawn at a time when the accumulated neutron fluence of the capsule corresponds to a value midway between the first and third capsules. The third capsule is recommended to be withdrawn at a time when the accumulated neutron fluence on the capsule corresponds to the approximate EOL fluence at the reactor vessel 1/4 thickness location. The fourth capsule is recommended to be withdrawn at a time when the accumulated neutron fluence on the capsule corresponds to the approximate EOL fluence at the reactor vessel inner wall location. And the fifth capsule is recommended to be withdrawn at not less than once or greater than twice the peak EOL vessel fluence. This capsule may be held without testing following withdrawal.

Currently, SCE&G has a five-capsule withdrawal schedule and a sixth capsule as a standby capsule. All five capsules scheduled for removal in SCE&G's coupon surveillance program have been removed and tested. The standby capsule is not scheduled to be removed until Refueling Outage 15 (RF-15) and upon removal will be placed in storage for future use. In order to monitor changes in the reactor vessel material due to neutron irradiation during the license extension period, the current reactor vessel surveillance program, which was designed based on a 40-year license, needs to be modified to accommodate a 60-year license. According to Section 3.1.2.3.6 of NUREG-1787, the licensee committed to modify the surveillance capsule withdrawal schedule. Specifically, Section 3.1.2.3.6 of NUREG-1787 states that the licensee will remove one of the two remaining capsules in RF-14, and will remove the last capsule in RF-15 and place this capsule in storage, and install alternate dosimetry during RF-15 to monitor reactor vessel fluence, which is consistent with NUREG-1801, "Generic Aging Lessons Learned Report" Section XI.M31.

4.0 EVALUATION

The licensee has opted to use the ASTM E185-82 standard and a five-capsule withdrawal schedule. The recommendations of ASTM E185-82 are discussed above. The proposed revisions to the reactor vessel surveillance capsules withdrawal schedule are based on ASTM E185-82 recommendations and reflect updated fluence information from Westinghouse

Commercial Atomic Power report WCAP-15101, "Analysis of Capsule W from SCE&G VC Summer Unit 1 Reactor Vessel Radiation Surveillance Program," dated September 1998. To develop a 60-year reactor vessel coupon surveillance program, SCE&G applied the guidance provided in ASTM E185-82 and calculated a projected reactor vessel inside diameter (ID) surface fluence at 60 years (56.678 EFPYs) of 6.4×10^{19} n/cm².

SCE&G has withdrawn five capsules for VCSNS. The first capsule was tested upon removal from the reactor vessel. The first capsule had an accumulated neutron fluence of 6.542×10^{18} n/cm², which meets the recommendation of ASTM E185-82 for the first capsule to be withdrawn and tested. The second capsule was tested upon removal from the reactor vessel. The second capsule had an accumulated neutron fluence of 1.538×10^{19} n/cm², which meets the ASTM E185-82 recommendation of the second capsule to be withdrawn and tested. The third capsule was tested upon removal from the reactor vessel. The third capsule had an accumulated neutron fluence of 2.543×10^{19} n/cm², which meets the ASTM E185-82 recommendation for the third capsule to be withdrawn and tested because it corresponds to a 60-year EOL 1/4 thickness (T) fluence. The fourth capsule was tested upon removal from the reactor vessel. The fourth capsule had an accumulated neutron fluence of 4.664×10^{19} n/cm², which meets the ASTM E185-82 recommendation for the fourth capsule to be withdrawn because it corresponds to a 60-year EOL ID fluence. During RF-14, the fifth capsule was withdrawn and tested. The fifth capsule, with a projected neutron fluence of 6.712×10^{19} n/cm², will also meet the ASTM E185-82 recommendation for the fifth capsule to be withdrawn and tested and will exceed the neutron fluence of the reactor vessel at the ID surface at 60 years of operation. In addition, SCE&G has a standby capsule, which will be removed in RF-15 and placed in storage for future use. The withdrawal of the fifth capsule in RF-14 and the withdrawal of the standby capsule in RF-15 satisfies the commitments of Section 3.1.2.3.6 of NUREG-1787. In a letter dated November 5, 2003, the licensee committed to install alternate dosimetry during RF-15 to monitor vessel fluence which is consistent with Section 3.1.2.3.6 of NUREG-1787.

The NRC staff has independently verified that the proposed capsule withdrawal and testing schedule for the capsules of the VCSNS RPV surveillance program are in accordance with the recommendations of ASTM E185-82. The NRC staff has independently verified that the proposed withdrawal schedule for the capsules of the VCSNS RPV surveillance program complies with the requirements of Appendix H to 10 CFR Part 50 and satisfies the commitments of Section 3.1.2.3.6 of NUREG-1787.

5.0 CONCLUSION

Based on the NRC staff's review of the SCE&G submittal, the NRC staff found that the revised coupon withdrawal schedule for VCSNS RPV satisfies the requirements of ASTM E185-82 and Appendix H to 10 CFR Part 50. In addition, the NRC staff found that the revised withdrawal schedules for VCSNS addresses the commitments in Section 3.1.2.3.6 of NUREG-1787. Therefore, the NRC staff concludes that SCE&G's modified withdrawal schedule for VCSNS is acceptable and satisfies the licensee commitments discussed in NUREG-1787 for the renewed license period of 60 years and the requirements of Appendix H to 10 CFR Part 50.

6.0 REFERENCES

1. Letter from S.A. Byrne, SCE&G, to NRC, "Reactor Coupon Surveillance Program Schedule Change," dated March 5, 2004.
2. Letter from S.A. Byrne, SCE&G, to NRC, "Comments on the Safety Evaluation Report Related to the License Renewal of the Virgil C. Summer Nuclear Station," dated November 2003.
3. Code of Federal Regulations, Title 10, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," dated January 1998.
4. American Society for Testing and Materials, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," ASTM E185-73 and ASTM E185-82.
5. NUREG-1787, "Safety Evaluation Report Related to the License Renewal of the Virgil C. Summer Nuclear Station," dated March 2004.

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Date: June 6, 2005

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