



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

September 4, 2015

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 – REVISION TO THE UNIT 1
REACTOR VESSEL SURVEILLANCE CAPSULE SCHEDULE FOR LICENSE
RENEWAL (TAC NOS. MF6620 AND MF6621)

Dear Mr. Shea:

By letter dated September 27, 2013, the Nuclear Regulatory Commission (NRC) staff transmitted a safety evaluation approving the revision of the pressure vessel surveillance capsule withdrawal schedule proposed by Tennessee Valley Authority (TVA) for Sequoyah Nuclear Plant, Units 1 and 2, in support of the proposed license renewal application. By letter dated May 14, 2015, TVA submitted a request to relocate Unit 1 surveillance Capsule V and further revise its withdrawal date.

The NRC staff reviewed TVA's May 14, 2015, submittal regarding the proposed relocation of Capsule V during the 21st, 22nd, or 23rd Refueling Outage, and its revised withdrawal date to End of Cycle 31. The NRC staff concludes that these proposed changes regarding Capsule V for Unit 1 are consistent with the requirements of Title 10, *Code of Federal Regulations*, Part 50, Appendix H, and guidelines of associated guidance documents. Therefore, the proposed changes are acceptable. Details of the NRC staff's review are set forth in the enclosed safety evaluation.

Sincerely,

A handwritten signature in black ink, appearing to read "Andrew Hon", with a stylized flourish at the end.

Andrew Hon, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosure: Safety Evaluation

cc w/enclosure: Distribution via Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

REVISION TO THE UNIT 1 REACTOR VESSEL SURVEILLANCE CAPSULE SCHEDULE

FOR LICENSE RENEWAL

DOCKET NO. 50-327 AND 50-328

1.0 INTRODUCTION

By letter dated September 27, 2013 (Reference 1), the Nuclear Regulatory Commission (NRC) staff transmitted a safety evaluation (SE) approving the revision of the pressure vessel surveillance capsule withdrawal schedule proposed by Tennessee Valley Authority (TVA, the licensee) for Sequoyah Nuclear Plant (SQN), Units 1 and 2. By letter dated May 14, 2015 (Reference 2), TVA submitted a request to further revise the withdrawal dates for reactor vessel (RV) surveillance capsules SQN Unit 1. The purpose of the revisions to the RV surveillance capsule withdrawal schedule is to support TVA's application for SQN license renewal to 60 years.

This SE supplements the September 27, 2013, SE for Unit 1 only. The schedule for Unit 2 is not proposed to change and is, thus, not addressed in this SE.

2.0 REGULATORY EVALUATION AND BACKGROUND

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," requires licensees to monitor changes in the fracture toughness properties of ferritic materials in the RV beltline region of light water nuclear power reactors that result from exposure of these materials to neutron irradiation and the thermal environment. Appendix H states that the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of American Society for Testing and Materials (ASTM) E185, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," that is current on the issue date of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code to which the RV was purchased, although the editions through ASTM E185-82 may be used. The applicable ASTM E185 for SQN, Units 1 and 2 is ASTM E185-82. Additionally, NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report" (Reference 3), and the requirements of 10 CFR Part 50, Appendix H require that the licensee submit the ASTM E185-82 compliant schedules to the NRC for approval.

Enclosure

The licensee's current RV material surveillance program for license renewal of Unit 1, which conforms to ASTM E185-82, was approved by NRC letter to TVA on September 27, 2013 (Reference 2). ASTM E185-82 recommends that sets of specimens be removed three or more separate times. As summarized in the Sequoyah Updated Final Safety Analysis Report, four capsules (with lead factors between 3.15 and 3.23) were used in the original withdrawal plan for the 40-year license with an additional four standby capsules, which were then located in lower fluence regions around the core (lead factors < 1.1). The final capsule associated with the initial surveillance program was Surveillance Capsule Y; Capsule Y was removed at 10.03 Effective Full Power Years (EFPY) for Unit 1.

The currently-approved surveillance program for Unit 1 involved relocating two of the standby surveillance capsules (Capsules S and W) from the low fluence regions to higher fluence locations in the RV. The move took place at the End of Cycle (EOC) 19. The objective of the relocation was to have meaningful data for the current pending license renewal, and possible future additional license renewal.

As discussed with NRC staff on April 30, 2015, in a telephone conference call, Capsules S and W from Unit 1 became dislodged from the capsule holder and were destroyed during Fuel Cycle 20. Thus, testing of the specimens from the capsules cannot be done according to the currently approved schedule.

To be consistent with the GALL report, the program must be revised so that a capsule will be withdrawn and tested at a neutron fluence level exceeding, but not greater than twice, the peak RV neutron fluence at 60 years of operation (52 EFPY for SQN). This guidance is also consistent with an extrapolation of ASTM E185-82 for the extended license period. The license renewal application for SQN, Unit 1 (Reference 4) is currently under NRC staff review.

TVA's May 14, 2015, submittal involves relocation of Capsule V, in lieu of the lost Capsules S and W, to obtain meaningful surveillance data for license renewal. The capsule relocation satisfies the criteria for changes under 10 CFR 50.59 so that NRC approval for moving the capsule from the low-fluence region to the position with a higher lead factor is not required.

TVA is requesting NRC review and approval of a proposed alternative withdrawal schedule that would support NRC staff approval of SQN's license renewal application. The proposed alternative withdrawal schedule continues to meet the provisions of the specific regulatory requirements of 10 CFR Part 50, Appendix H and the license renewal rule, 10 CFR Part 54.

3.0 TECHNICAL EVALUATION

The original surveillance capsule withdrawal plan spanning the initial license period has already been completed and Capsules S and W, which were moved at EOC 19, are lost, and therefore, are not part of this evaluation. Additionally, the remaining standby Capsule Z is not affected by this change and is not a part of this evaluation. The licensee stated in Reference 2 that the revised plan is to move Capsule V at the EOC 21, 22, or 23, and withdraw Capsule V at the revised withdrawal date EOC 31. Given that Surveillance Capsule V is moved to the higher fluence location on or before EOC 23, the requested change to the withdrawal schedule would provide a minimum neutron fluence for the test samples in Capsule V of $2.97\text{E}+19$ n/cm² (E>1 MeV). The maximum fluence for the license renewal period at SQN, Unit 1 (52 EFPY) has been estimated to be $2.66\text{E}+19$ n/cm² (E>1 MeV). Therefore, the revised schedule for Unit 1 will

result in the fluence on Capsule V exceeding the peak RV neutron fluence at 60 years of operation, but will not be greater than twice the peak for the vessel. If Capsule V is moved earlier, the fluence on Capsule V will be higher, but given that the fluence is increasing by about $0.2E+19$ n/cm² (E>1 MeV) per cycle, the maximum fluence will still be less than twice the peak for the vessel.

Given the information provided in Reference 2, the NRC staff finds that TVA's proposed schedule meet the intent of ASTM E185-82 when extrapolated to 60 years of operation, the guidance of the GALL report (Reference 3) for the period of extended operation, and the requirements of 10 CFR Part 50, Appendix H. Therefore, the NRC staff concludes that the proposed change in schedule is acceptable.

4.0 CONCLUSION

The NRC staff reviewed the licensee's May 14, 2015, submittal regarding the proposed relocation of Capsule V during the 21st, 22nd, or 23rd refueling outage, and the withdrawal date of the relocated Capsule V to EOC 31. The NRC staff concludes that these proposed changes regarding Capsule V for Unit 1 are consistent with the recommendations specified in ASTM E185-82 as referenced by the requirements of 10 CFR Part 50, Appendix H. Furthermore, the proposed changes meet the guidance in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 1, Section XI.M31. Therefore, the proposed changes are acceptable.

5.0 REFERENCES

1. Lingam, S. P., U.S. Nuclear Regulatory Commission, letter to J. W. Shea, Tennessee Valley Authority, "Sequoyah Nuclear Plant, Units 1 and 2 – Revise the Reactor Vessel Material Surveillance Capsule Withdrawal Schedule Due to License Renewal Amendment" (TAC Nos. MF0631 and MF0632), dated September 27, 2013 (ADAMS Accession No. ML13240A320).
2. Shea, J. W., Tennessee Valley Authority, letter to U.S. Nuclear Regulatory Commission, "Sequoyah Nuclear Plant -- Revision to the Reactor Pressure Vessel Surveillance Program Withdrawal Schedule for License Renewal," dated May 14, 2015 (ADAMS Accession No. ML15134A377).
3. Section XI.M31, NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," Nuclear Regulatory Commission, December 2010.
4. Tennessee Valley Authority, submittal to U.S. Nuclear Regulatory Commission, "Sequoyah Nuclear Plant, Units 1 and 2, License Renewal Application," dated January 7, 2013 (ADAMS Accession No. ML130240007).

Principal Contributor: Patrick T. Purtscher

Date: September 4, 2015

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Tennessee Valley Authority
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Sincerely,
/RA by PTam for/
Andrew Hon, Project Manager
Plant Licensing Branch II-2
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