



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-15-095

May 14, 2015

10 CFR 50.4
10 CFR 50, Appendix H

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Unit 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: **SEQUOYAH NUCLEAR PLANT- REVISION TO THE REACTOR
PRESSURE VESSEL SURVEILLANCE CAPSULE WITHDRAWAL
SCHEDULE FOR LICENSE RENEWAL**

- References:
1. NRC letter to TVA, Sequoyah Nuclear Plant, Units 1 and 2 – Revise the Reactor Pressure Vessel Material Surveillance Capsule Withdrawal Schedule due to License Renewal Amendment (TAC NOS. MF0631 and MF0632), dated September 27, 2013
 2. TVA letter to NRC, Sequoyah Reactor Pressure Vessel Surveillance Capsule Withdrawal Schedule Revision Due to License Renewal Amendment, dated January 10, 2013

By the Reference 1 letter, NRC provided acceptance of the Tennessee Valley Authority (TVA) revised reactor pressure vessel (RPV) material surveillance specimen withdrawal schedule for Sequoyah (SQN), Units 1 and 2. The revised withdrawal schedule had been submitted by TVA's Reference 2 letter and supported license renewal of SQN, Units 1 and 2 operating licenses for an additional 20 years. The revised schedule was based on relocation of the "S" and "W" surveillance capsules for Units 1 and 2. The capsule relocation was completed during each unit's end of cycle (EOC) R19. The objective of this relocation was to place surveillance capsules in a leading fluence location so that the revised surveillance specimen withdrawal schedule would comply with the expectations of American Society for Testing and Materials (ASTM) E 185-82, NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," and the requirements of 10 CFR 50, Appendix H.

As discussed with NRC staff on April 30, 2015, unanticipated damage to the "S" and "W" capsule specimens was discovered during Unit 1 EOC R20. TVA is requesting NRC review and approval of a proposed alternative withdrawal schedule that would support staff approval of SQN's License Renewal Application. The proposed alternative withdrawal schedule continues to meet the provisions of the specific regulatory requirements for the License Renewal Rule, 10 CFR Part 54, [i.e., (ASTM) E 185-82, NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," and the requirements of 10 CFR 50, Appendix H].

Relocation of Unit 1 reactor vessel surveillance Capsule V from the 176-degree azimuthal location to the 140-degree azimuthal location, a higher fluence location, is required to support the proposed alternative capsule withdrawal schedule. Because the relocation of the SQN Unit 1 surveillance capsule screens out under 10 CFR 50.59, NRC approval of the relocation is not required (see Enclosure 3).

No changes are requested in the NRC approved Unit 2 reactor vessel material surveillance capsule withdrawal schedule.

Based on the technical justification for the proposed change provided in WCAP-17539-NP, Revision 1 (Enclosure 2) and as discussed in Enclosure 1, TVA concludes that the proposed changes comply with ASTM Standard Practice E 185-82.

If you have any questions regarding this submittal, please contact Ms. Erin Henderson, Sequoyah Site Licensing Manager at (423) 843-7170.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 14th day of May 2015.

Respectfully,



J. W. Shea
Vice President, Nuclear Licensing

- Enclosures
1. Request for Revision to Reactor Vessel Material Surveillance Capsule Withdrawal Schedule for Sequoyah Nuclear Plant Unit 1
 2. WCAP-17539-NP Revision 1, May 2015
 3. Westinghouse Electric Company -10 CFR 50.59 Applicability and Screening Review – Reactor Vessel Surveillance Capsule Relocation

cc: NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Sequoyah Nuclear Plant
NRR Project Manager - Sequoyah Nuclear Plant

ENCLOSURE 1

Tennessee Valley Authority Sequoyah Nuclear Plant Unit 1

Request for Revision to Reactor Vessel Material Surveillance Capsule Withdrawal Schedule for Sequoyah Nuclear Plant Unit 1

1. Background

In Reference 1, Tennessee Valley Authority (TVA) proposed a revision to the Unit 1 Reactor Vessel Surveillance Capsule withdrawal schedule to support renewal of the Sequoyah (SQN) Unit 1 operating license for an additional 20 years. In Reference 2, TVA responded to an NRC Request for Additional Information (RAI) regarding the Reference 1 proposed schedule change. In Reference 3, the NRC approved the proposed revised reactor vessel material surveillance capsule withdrawal schedule. The NRC review concluded, given that the relocation of Capsules S and W occurs during the 19th or 20 refueling outages, the revised withdrawal schedule date of the end of cycle (EOC) 28 for Unit 1 for surveillance capsule S is acceptable.

SQN relocated Capsules S and W to higher fluence locations at EOC 19 on Unit 1 in accordance with the relocation plan established in Reference 1. Inspection of the Unit 1 Reactor Vessel at EOC 20 revealed that the S and W capsules had become dislodged from the capsule holders and were destroyed. As a result, the planned S capsule withdrawal at EOC 28 on Unit 1 cannot be performed and an alternative Unit 1 capsule withdrawal schedule must be proposed.

Relocation of Unit 1 reactor vessel surveillance Capsule V from the 176-degree azimuthal location to the 140-degree azimuthal location, a higher fluence location is required to support the proposed alternative capsule withdrawal schedule.

2. Proposed Revision To The Withdrawal Schedule for SQN Unit 1

TVA is planning to relocate Capsule V in Unit 1 EOC 21, 22 or 23. The proposed revised Unit 1 schedule is to withdraw the relocated Unit 1 Capsule V (140-degree location after relocation from location 176-degree) during the EOC 31 (see FSAR Figure 5.4.3-3 below for location azimuths).

The Unit 1 Reactor Vessel Surveillance Capsules S and W withdrawal schedule defined in Reference 1 and approved by the NRC in Reference 3 is withdrawn due to the loss of these two capsules. The removal schedule for Capsule Z in Unit 1 will remain unchanged at this time.

3. Technical Justification for SQN Unit 1

As stated in SQN FSAR Section 5.4.3.7, Reactor Vessel Material Surveillance Program Requirements, Unit 1 Capsules T, U, X and Y have been previously withdrawn for specimen testing for the 40-year operational period. With the permanent loss of Capsules S and W, Capsules V and Z are the remaining capsules in the SQN Unit 1 reactor vessel. SQN Unit 1 Capsules V and Z are located at the 176-degree and 356-degree locations, respectively.

TVA has submitted an application for the renewal of the SQN Units 1 and 2 operating licenses that proposes to extend the plant operating licenses for an additional 20 years. To account for the license renewal, TVA proposes to withdraw one of the remaining two capsules (Capsule V) from Unit 1 after the capsule is relocated to the 140-degree location and receives neutron fluence greater than the 60-year vessel fluence or 52 EFPY, that is deemed end-of-license extension (EOLE). The remaining spare capsule, Capsule Z, will stay in the reactor vessel for future license renewal use. The removal schedule for Capsule Z remains unchanged from that contained in the FSAR.

The proposed surveillance capsule withdrawal schedule is based on the requirements specified in ASTM E 185-82, Section 7.6. In accordance with the requirements of ASTM E 185-82, Section 7.6, after the relocation of Capsule V, TVA proposes to withdraw Capsule V from Unit 1 after its vessel fluence exposure exceeds the new peak EOLE (52 EFPY) vessel fluence, but prior to exceeding twice that fluence exposure to support the application to extend the SQN Unit 1 operating license.

Reference 4 (WCAP 17539-NP), Revision 0, developed by Westinghouse to perform the Time-Limited Aging Analyses (TLAA) for the SQN Units 1 and 2 reactor pressure vessels in accordance with the requirements of the License Renewal Rule, 10 CFR Part 54, updated the reactor vessel fluence evaluation. The fluence evaluation included a plant and fuel specific analysis for fuel cycles 1 through 18 for Unit 1. Projections were then made for future operation through EOLE (60 years of plant life or 52 EFPY of operation). Reference 4 provided the technical basis for the revised capsule removal schedule proposed by TVA in Reference 1 and approved by the NRC in Reference 3.

WCAP 17539-NP has been revised (Reference 5) to recognize that Capsules S and W have been destroyed and to define a revised Capsule V removal plan. The changes in WCAP 17539-NP, Revision 1, were limited to the changes associated with the delay in repositioning a capsule from a lagging position to a leading position. No changes were made in the Unit 1 reactor vessel fluence evaluation and the projection of the reactor vessel fluence through EOLE.

Per Reference 5, Table 2-1, the maximum reactor vessel fluence at 52 EFPY for Unit 1 is projected to be 2.66×10^{19} n/cm² (E>1.0 MeV). In accordance with the requirements of ASTM E 185-82, Section 7.6, the surveillance capsules should be removed when their neutron fluence exceeds the new peak EOLE vessel fluence (i.e., 2.66×10^{19} n/cm² for Unit 1 at 52 EFPY), but prior to exceeding twice that fluence exposure (i.e., 5.32×10^{19} n/cm² for Unit 1).

In Reference 5, Appendix B, Table B.1-4, relocation of Unit 1 Capsule V from the 176-degree position to the 140-degree position results in Capsule V reaching EOLE vessel fluence exposure (2.66×10^{19} n/cm²) at 35.4 EFPY, 36.4 EFPY, and 37.3 EFPY, for EOC 21, EOC 22, and EOC 23, respectively (Table 1).

Table 1
SQN U1 Potential Capsule V Withdrawal Times Associate with Relocation from the 176-degree Azimuthal Location to the 140-degree Azimuthal Location

Capsule Relocation Time	Capsule Time (EFPY) Corresponding to Vessel Life ^(a)
	60 Years of Operation (52 EFPY)
EOC 21	35.4
EOC 22	36.4
EOC 23	37.3

Note:

- a) These dates are based on the capsule fluence being equivalent to one times the peak vessel fluence at 60 years (2.66×10^{19} n/cm²)

In Reference 5, Appendix B, Table B.1-5, provides the earliest EOC outage after the Unit 1 Capsule V exceeds the EOLE vessel fluence exposure (2.66×10^{19} n/cm²) if repositioned to the 140-degree position at EOC 23 (Table 2). Because the 140-degree location has a lead factor of 3.23, relocation of Unit 1 Capsule V to the 140-degree location at EOC 21 or EOC 22 will also exceed the EOLE vessel fluence exposure.

Table 2
SQN U1 Future Capsule V Withdrawal Outage Number Associated with Capsule Relocation from 176-degree Azimuthal location to 140-degree Azimuthal Location at EOC 23 in Support of 60 Total Years of Operation

Outage Number	EFPY	Capsule Fluence ($\times 10^{19}$ n/cm ² , E>1.0MeV)
EOC 30	38.10	2.78
EOC 31	39.43	2.97
EOC 32	40.76	3.17

The projected Capsule V capsule time (39.43 EFPY) and fluence (2.97×10^{19} n/cm²) at the end of Unit 1 Cycle 31 is greater than the earliest withdrawal EFPY of 37.3 and fluence (2.66×10^{19} n/cm²) for the bounding Capsule V relocation time. The projected Capsule V fluence (2.97×10^{19} n/cm²) at EOC 31 does not exceed twice the EOLE vessel fluence exposure (5.32×10^{19} n/cm²). Relocation of Capsule V at EOC 21 or EOC 22 will also result in a fluence less than twice the EOLE vessel fluence. Therefore, withdrawal of the Unit 1 Capsule V, relocated from the 176-degree azimuthal location at either EOC 21, 22 or 23 complies with the requirements of 10 CFR 50, Appendix H and ASTM E 185-82 for 60 years (52 EFPY) of operation.

Table 3 provides the proposed FSAR revised capsule removal schedule that complies with the requirements of ASTM E 185-82 for 60 years (52 EFPY) of operation. The SQN FSAR will be updated following relocation of Capsule V.

Table 3
Proposed FSAR Reactor Vessel Capsule Removal Schedule for Unit 1

Capsule Number	Vessel Location	Lead Factor ^(c)	Withdrawal Time^(c) (EFPY)	Neutron Fluence (x 10¹⁹ n/cm², E>1.0 MeV)
T	40 ⁰	3.15	1.07 (removed)	0.241
U	140 ⁰	3.23	2.85 (removed)	0.693
X	220 ⁰	3.22	5.26 (removed)	1.16
Y	320 ⁰	3.18	10.02 (removed)	1.97
S	N/A	N/A	Destroyed ^(a)	N/A
V	140 ^{0(b)}	3.23	EOC 31	2.66 ^(d)
W	N/A	N/A	Destroyed ^(a)	N/A
Z	356 ⁰	0.90	Standby	N/A

Notes:

- a) Capsule S was relocated to the 40-degree azimuthal location and Capsule W was relocated to the 220-degree azimuthal location at EOC 19 and were found destroyed at EOC 20.
- b) Capsule V was relocated from the 176-degree location to the 140-degree location.
- c) Values taken from WCAP 17539-NP, Revision 1, Table 7-1 (Reference 5).
- d) Neutron fluence values shown are the 60-year peak reactor vessel values. The Capsule V fluence values at EOC 31 will exceed the 60-year peak reactor vessel fluence values assuming Capsule V is relocated at either EOC 21, 22 or 23, as shown in Table 2.

In summary, TVA is planning to relocate the Unit 1 Capsule V from the current 176-degree azimuthal location to the 140-degree azimuthal location at either EOC 21, 22 or 23. TVA is proposing a revised Unit 1 Capsule V withdrawal schedule to support the application for a SQN Unit 1 renewed license. The proposed revised schedule is to withdraw the relocated Unit 1 Capsule V during the EOC 31 outage. The remaining Capsule Z in Unit 1 will remain in standby.

4. References

- 1) TVA letter to NRC, Sequoyah Reactor Pressure Vessel Surveillance Capsule Withdrawal Schedule Revision Due to License Renewal Amendment, dated January 10, 2013.
- 2) TVA letter to NRC, Response to NRC Request for Additional Information Regarding Reactor Pressure Vessel Surveillance Capsule Withdrawal Schedule Revision (TAC Nos. MF0631 and MF0632), dated July 3, 2013.
- 3) NRC Letter to TVA, Sequoyah Nuclear Plant, Units 1 and 2 – Revise the Reactor Pressure Vessel Material Surveillance Capsule Withdrawal Schedule Due To License Renewal Amendment (TAC NOs. MF0631 and MF0632), dated September 27, 2013.
- 4) Westinghouse Report WCAP-17539-NP, Revision 0, "SEQUOYAH NUCLEAR PLANT Units 1 and 2 Time-Limited Aging Analysis on Reactor Vessel Integrity," March 2012.
- 5) Westinghouse Report WCAP-17539-NP, Revision 1, "SEQUOYAH NUCLEAR PLANT Units 1 and 2 Time-Limited Aging Analysis on Reactor Vessel Integrity," May 2015.

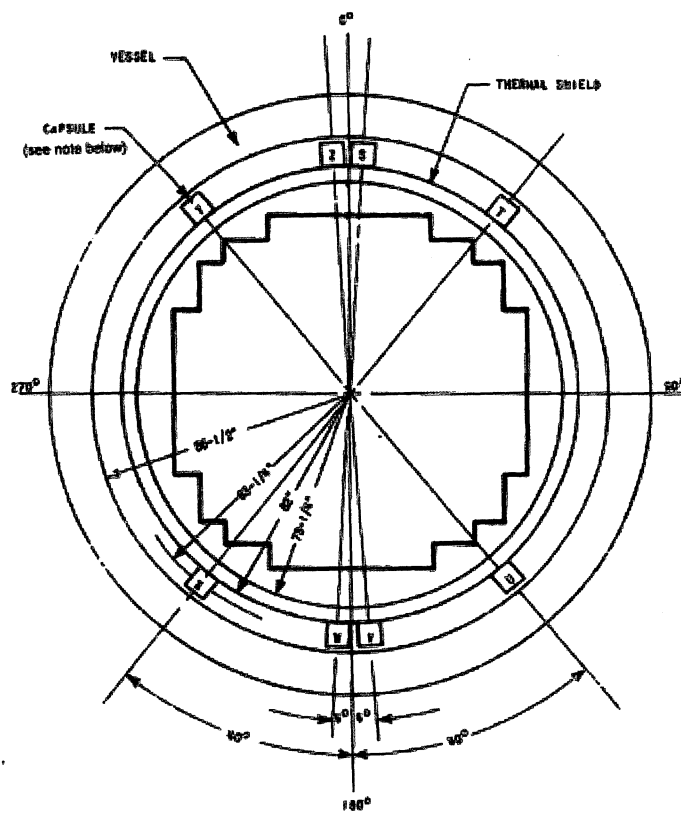


Figure 5.4.3-3 Surveillance Capsule Plan View

ENCLOSURE 2

**Tennessee Valley Authority
Sequoyah Nuclear Plant Units 1 and 2**

**Westinghouse
WCAP-17539-NP, Revision 1
Sequoyah Units 1 and 2
Time-Limited Aging Analysis on Reactor Vessel Integrity
(Non-Proprietary)**