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

November 20, 2017

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

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – REVISION TO THE REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (CAC NO. MG0207; EPID L-2017-LLL-0019)

Dear Mr. Shea:

By letter dated September 5, 2017 (Agencywide Documents Access and Management System Accession No. ML17248A420), as supplemented by letter dated October 13, 2017 (ADAMS Accession No. ML17289A327), the Tennessee Valley Authority submitted a request for U.S. Nuclear Regulatory Commission (NRC) staff review and approval to revise the reactor vessel surveillance capsule removal schedule for Watts Bar Nuclear Plant, Unit 2. Specifically, the licensee requested NRC approval to revise the surveillance capsule withdrawal schedule for Capsule U from the first refueling outage in fall 2017 to the subsequent outage in the spring of 2019.

The NRC staff has reviewed the licensee's submittal and concludes that it is acceptable because it is consistent with Appendix H to 10 CFR Part 50 and American Society for Testing and Materials Standard Practice E185-82.

Sincerely,

Robert G. Schaaf, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

Enclosure:
Safety Evaluation

cc: Listserv

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO REVISE THE SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

FOR THE REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-391

1.0 INTRODUCTION

By letter dated September 5, 2017 (ADAMS Accession No. ML17248A420), the Tennessee Valley Authority (the licensee) submitted a request to revise the surveillance capsule withdrawal schedule for the reactor vessel material surveillance program for the Watts Bar Nuclear Plant (Watts Bar), Unit 2. Capsule U was scheduled to be withdrawn during the first Watts Bar, Unit 2 refueling outage during October 2017. This scheduled capsule withdrawal was based on the capsule neutron fluence exceeding 0.50E19 n/cm^2 in accordance with Table 1 of American Society for Testing and Materials (ASTM) E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels." However, under the current Watts Bar, Unit 2 operating schedule, the targeted neutron fluence value of at least 0.50E19 n/cm^2 will not be achieved until the end of Cycle 2. The submittal requests Nuclear Regulatory Commission (NRC) approval to revise the surveillance capsule withdrawal schedule for Capsule U from the first refueling outage to the subsequent outage in the spring of 2019, corresponding to 2.61 effective full-power years (EFPY) and a capsule neutron fluence 0.77E19 n/cm^2. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," requires that proposed changes to the withdrawal schedule be approved prior to implementation.

The licensee's September 5, 2017, submittal referenced WCAP-18191-NP, Revision 0, "Watts Bar Unit 2 Heatup and Cooldown Limit Curves for Normal Operation and Supplemental Reactor Vessel Integrity Evaluations," dated May 2017, as the information source for the revised lead factor, removal time, and expected capsule fluence for capsule U. By letter dated October 13, 2017 (ADAMS Accession No. ML17289A327), the licensee provided a copy of WCAP-18191-NP to support the staff's review of the requested revision to the capsule withdrawal schedule for Capsule U.

2.0 REGULATORY EVALUATION

Nuclear power plant licensees are required by Appendix H to 10 CFR Part 50 to implement reactor vessel material surveillance programs to "monitor changes in the fracture toughness

properties of ferritic materials in the reactor vessel beltline region . . . which result from exposure of these materials to neutron irradiation and the thermal environment." Plant-specific surveillance programs must be consistent with the requirements of ASTM Standard Practice E185. In the design of a plant-specific surveillance program, a licensee may use the edition of ASTM Standard Practice E185, which was current on the issue date of the American Society of Mechanical Engineers Code to which the reactor vessel was purchased, or later editions through the 1982 edition. The withdrawal schedule in Table 1 of ASTM E185-82 is defined for the original operating period of 40 years (estimated at 32 EFPY).

Appendix H of 10 CFR Part 50 describes reactor vessel material surveillance program requirements. Paragraph (III)(B)(3) requires that, "a proposed withdrawal schedule must be submitted with a technical justification as specified in Section 50.4. The schedule must be approved prior to implementation."

3.0 TECHNICAL EVALUATION

The current surveillance capsule withdrawal schedule is contained in Table 4.0-1 of the Watts Bar, Unit 2 Pressure-Temperature Limits Report (PTLR).

Table 1 of ASTM E185-82 specifies the minimum recommended number of surveillance capsules and their withdrawal schedule. The number of capsules to be withdrawn and tested is based on the limiting reference temperature nil ductility transition (RT_{NDT}) shift (ΔRT_{NDT}) that is projected to occur at the reactor vessel clad-to-base metal interface at the end-of-license (EOL) for the facility. Watts Bar, Unit 2 has a projected ΔRT_{NDT} less than 100 degrees Fahrenheit (°F), therefore a minimum of three capsules are required for the 40-year operating period. The withdrawal schedule identifies these as Capsule U, Capsule W, and Capsule X. Three capsules are identified as standby capsules: Capsule Z, Capsule V and Capsule Y.

Table 1 of ASTM E185-82 further recommends that the first capsule be scheduled for withdrawal at 6 EFPY or at the time when the accumulated neutron fluence of the capsule exceeds 0.50E19 n/cm^2 or at the time when the highest predicted ΔRT_{NDT} of all encapsulated materials is approximately 50 °F, whichever comes first. The licensee stated that with the following considerations: (1) assuming 1.5 EFPY per 18-month cycle, 6 EFPY would be projected at Cycle 4 or later and (2) the highest predicted ΔRT_{NDT}, corresponding to the intermediate to lower shell forging circumferential weld, is not projected to exceed 50 °F before EOL, achieving surveillance capsule neutron fluence greater than 0.50E19 n/cm^2 would be the first of the three criteria reached for determination of the withdrawal schedule for the first capsule for Watts Bar, Unit 2. Capsule U, was scheduled for withdrawal during the first refueling outage, at a corresponding capsule neutron fluence of 0.50E19 n/cm^2. The licensee revised the neutron fluence projections for Capsule U from 0.50E19 n/cm^2 to 0.43E19 n/cm^2 at the end of Cycle 1. The projected neutron fluence for Capsule U at the end of the second cycle is projected to be 0.771E19 n/cm^2. Therefore, the staff finds the withdrawal schedule change from the first to the end of the second cycle so that Capsule U achieves a neutron fluence greater than 0.50E19 n/cm^2 to be consistent with Table 1 of ASTM E185-82.

4.0 CONCLUSION

The NRC staff has reviewed the proposed revision to the Watts Bar, Unit 2 reactor vessel material surveillance capsule withdrawal schedule, and concludes that it is acceptable because it is consistent with Appendix H to 10 CFR Part 50 and ASTM E185-82. Staff review of the reference document WCAP-18191-NP, "Watts Bar Unit 2 Heatup and Cooldown Limit Curves

for Normal Operation and Supplemental Reactor Vessel Integrity Evaluation," was limited to the changes for Capsule U contained in Appendix F, "Surveillance Capsule Withdrawal Schedule." Staff did not review the remainder of the document and, therefore, does not approve WCAP-18191-NP or any Appendices other than the changes to the withdrawal schedule for Capsule U in Appendix F. With approval of the requested reactor vessel material surveillance capsule withdrawal schedule change, the licensee shall submit the revised Watts Bar, Unit 2 PTLR reflecting the revised withdrawal schedule for Capsule U in the Watts Bar, Unit 2 surveillance capsule withdrawal schedule to the NRC, as required by Technical Specification 5.9.6, "Reactor Coolant System Pressure and Temperature Limits Report."

Principal Contributor: Carolyn Fairbanks

Date: November 20, 2017

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – REVISION TO THE REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (CAC NO. MG0207; EPID L-2017-LLL-0019) DATED NOVEMBER 20, 2017.

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ADAMS Accession No.: ML17312A260 ***by memo**

OFFICE	DORL/LPL2-2/PM	DORL/LPL2-2/LA	DMLR/MVIB/BC*	DORL/LPL2-2/BC	DORL/LPL2-2/PM
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DATE	11/16/2017	11/15/2017	11/3/2017	11/17/2017	11/20/2017

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