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

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 / RENEWED LICENSE NO. DPR-23

SUBJECT: REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE REMOVAL SCHEDULE

REFERENCES:

1. Duke Energy letter (RNP), *License Amendment Request Proposing to Revise Technical Specification 3.4.3, "RCS Pressure and Temperature (P/T) Limits,* dated February 7, 2018 (ADAMS Accession No. ML18038B289)
2. NRC letter, *H. B. Robinson Steam Electric Plant, Unit No. 2 – Issuance of Amendment No. 260 Regarding Request to Revise Technical Specification Reactor Coolant System Pressure and Temperature Limits to Reflect 24-Month Fuel Cycles (EPID L-2017-LLA-0033)*, dated August 16, 2018 (ADAMS Accession No. ML18200A042)

Ladies and Gentlemen:

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR), Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," Paragraph III.B.3, Duke Energy Progress, LLC (Duke Energy) is requesting Nuclear Regulatory Commission (NRC) approval of the enclosed revision to the reactor pressure vessel (RPV) surveillance capsule removal schedule for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

By letter dated February 7, 2018 (Reference 1), Duke Energy submitted a license amendment request (LAR) for HBRSEP to revise Technical Specification (TS) 3.4.3, "RCS Pressure and Temperature (P/T) Limits," to reflect that Figures 3.4.3-1 and 3.4.3-2 (P/T limit curves) are applicable up to 46.3 effective full power years (EFPY) instead of 50 EFPY with the removal of part length shield assemblies (PLSAs) and migration to 24-month fuel cycles. The NRC approved the revised P/T limit curves in its Safety Evaluation Report (SER) dated August 16, 2018 (Reference 2).

The proposed RPV surveillance capsule removal schedule was developed in Attachment 2 of Reference 1 (WCAP-18215, "H.B. Robinson Unit 2 End-of-License Extension Reactor Vessel Integrity Evaluations and Feasibility Study"), which includes an evaluation of HBRSEP reactor vessel integrity under the scenario that includes a migration to 24-month fuel cycles and no longer using PLSAs. Table 7-2 of WCAP-18215 provides the corresponding changes to the surveillance capsule withdrawal schedule required to satisfy the requirements of American Society for Testing and Materials (ASTM) E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels", dated July 1, 1982.

This document contains the following regulatory commitment:

> Capsule U will be withdrawn at 41.3 effective full-power years (EFPY) or during the scheduled outage after the 80-year peak vessel fluence is reached, but prior to 57.1 EFPY.

The above commitment replaces the existing commitment to be withdrawn at 38.0 EFPY or during the scheduled outage after the 80-year peak vessel fluence is reached.

Approval of this proposed change is requested one year from the date this submittal is accepted by the NRC staff for review.

Should you have any questions concerning this letter, or require additional information, please contact Art Zaremba, Manager – Nuclear Fleet Licensing, at 980-373-2062.

Sincerely,

M. Christopher Nolan
Vice President Nuclear Regulatory Affairs, Policy & Emergency Preparedness

MCN/aqg

Enclosure 1: Evaluation of the Proposed Change
Enclosure 2: Regulatory Commitment

cc: (all with Attachments unless otherwise noted)

C. Haney, Regional Administrator USNRC Region II
J. Rotton, USNRC Senior Resident Inspector – RNP
N. Jordan, NRR Project Manager – RNP

ENCLOSURE 1

EVALUATION OF THE PROPOSED CHANGE

Subject: **REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE REMOVAL SCHEDULE**

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1.0 INTRODUCTION

This evaluation supports a request from Duke Energy Progress, LLC to revise the reactor vessel surveillance program (RVSP) capsule withdrawal schedule for the H.B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

The proposed revision would align the HBRSEP withdrawal schedule with the projections of neutron fluence for the unit at the end of life for extended operations while still satisfying the requirements of American Society for Testing and Materials (ASTM) E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels" (Reference 1). The HBRSEP RPV surveillance capsule withdrawal schedule presently includes removal and subsequent testing of surveillance Capsule U at 38.0 effective full-power years (EFPY) or during the scheduled outage after the 80 year peak vessel fluence is reached. HBRSEP is requesting approval to revise the RV surveillance capsule withdrawal schedule and remove Capsule U at 41.3 EFPY or during the scheduled outage after the 80-year peak vessel fluence is reached, but prior to 57.1 EFPY

This submittal is made in accordance with the provision of 10 CFR 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements." Paragraph (III)(B)(3) specifies that a proposed withdrawal schedule must be submitted with a technical justification as specified by 10 CFR 50.4, and that the proposed schedule must be approved prior to implementation.

2.0 BACKGROUND

The NRC has established requirements and criteria in 10 CFR 50.60 for protecting reactor vessels against fracture. The rule requires the reactor vessel material surveillance program meet the requirements set forth in Appendix H to 10 CFR 50, “Reactor Vessel Material Surveillance Program Requirements.”

Appendix H to 10 CFR 50 provides the NRC staff’s criteria for the design and implementation of the reactor vessel material surveillance programs for operating reactors. The rule, in part, requires reactor vessel surveillance program designs and withdrawal schedules to meet the requirements of American Society of Testing and Materials (ASTM) Standard Practice E185, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels,” which is current on the issue date of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code to which the reactor vessel was purchased, although later editions of ASTM E185 may be used inclusive of the 1982 Edition of ASTM E185 (ASTM E185-82). This rule also requires proposed reactor vessel surveillance programs to be submitted to the NRC and approved prior to implementation.

In NRC Administrative Letter (AL) 97-04, "NRC Staff Approval for Changes to 10 CFR Part 50, Appendix H, Reactor Vessel Surveillance Specimen Withdraw Schedules," the Commission found that while 10 CFR Part 50, Appendix H, requires prior NRC approval for all withdrawal schedule changes, only certain changes require the NRC staff to review and approve the changes through the NRC's license amendment (10 CFR 50.90) process. Specifically, only those changes that are not in conformance with the ASTM standard referenced in 10 CFR Part 50, Appendix H (i.e., ASTM E185), are required to be approved through the license amendment process, whereas changes that are determined to conform to the ASTM standard only require that the NRC staff document its review and verification of such conformance.

The request is also submitted to satisfy HBRSEP renewed operating license condition 3.L "Reactor Vessel Surveillance," that states:

> All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC.

The Electric Power Research Institute (EPRI) developed a Coordinated Reactor Vessel Surveillance Program (CRVSP) for PWRs for the purpose of increasing the population of higher-fluence surveillance data (> $3E+10^{19}$ n/cm^2 , E>1 MeV). The program is documented in EPRI Technical Report, “Materials Reliability Program: Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines (MRP-326)," dated 2011 (Reference 5). The general premise of the program is to defer the withdrawal of certain capsules (e.g., those capsules which can provide high-fluence data for specific materials of interest before ~2025) while maintaining compliance with 10 CFR 50 Appendix H and Revision 2 of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report" (Reference 6). Revision 2 of the "GALL Report" is cited because it recommends license renewal capsule testing be performed between one and two times the 60-year peak reactor pressure vessel (RPV) fluence, as compared to guidance in Revision 1 of the "GALL Report” to test the capsule at the 60-year fluence.

By letter dated September 28, 2011 (Reference 7), Duke Energy requested NRC review and approval of a revision to the HBRSEP RPV surveillance capsule removal schedule. The requested change was submitted in accordance with the provision of 10 CFR 50, Appendix H, Paragraph (III)(B)(3), and MRP-326. The NRC approved the revised RPV surveillance capsule removal schedule in its Safety Evaluation Report (SER) dated December 21, 2011 (Reference 8).

By letter dated February 7, 2018 (Reference 9), Duke Energy submitted a license amendment request (LAR) for HBRSEP to revise Technical Specification (TS) 3.4.3, "RCS Pressure and Temperature (P/T) Limits," to reflect that Figures 3.4.3-1 and 3.4.3-2 (P/T limit curves) are applicable up to 46.3 effective full power years (EFPY) instead of 50 EFPY with the removal of part length shield assemblies (PLSAs) and migration to 24-month fuel cycles. The NRC approved the revised P/T limit curves in its Safety Evaluation Report (SER) dated August 16, 2018 (Reference 10). The basis for the proposed RPV surveillance capsule removal schedule was developed in Attachment 2 of the Reference 9 (WCAP-18215, "H.B. Robinson Unit 2 End-of-License Extension Reactor Vessel Integrity Evaluations and Feasibility Study”), which includes an evaluation of HBRSEP reactor vessel integrity under the scenario that includes a migration to 24-month fuel cycles and no longer using PLSAs. Table 7-2 of WCAP-18215 provides the corresponding changes to the surveillance capsule withdrawal schedule required to satisfy the requirements of American Society for Testing and Materials (ASTM) E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels", dated July 1, 1982. HBRSEP has reviewed the proposed changes to the surveillance capsule withdrawal schedule and determined a change to the 10 CFR 50 Appendix H schedule is appropriate.

3.0 CURRENT RVSP WITHDRAWAL SCHEDULE FOR HBRSEP

The currently approved reactor vessel surveillance capsule removal schedule is as follows:

The following shows the schedule for removal of the Reactor Vessel Materials Surveillance Capsules U, Y, and W, as outlined in UFSAR Section 5.3.1.6:

Capsule	Effective Full Power Years
U (See Note 1)	38.0
Y (See Note 2)	Reserve
W (See Note 2)	Reserve

Note 1: Capsule to location 280° at Cycle 8. Capsule will reach a fluence of approximately 7.84×10^{19} n/cm^2 (66 EFPY peak fluence) at approximately 38.0 EFPY. Thus, Capsule U should be withdrawn at 38.0 EFPY or during the scheduled outage after the 80 year peak vessel fluence is reached.

Note 2: Capsules Y was relocated to the 290° holder position and Capsule W was relocated to the 270° holder position during RO-27.

4.0 PROPOSED RVSP WITHDRAWAL SCHEDULE FOR HBRSEP

H.B. Robinson Unit 2 has pulled and tested four surveillance capsules. To satisfy the surveillance capsule provisions of ASTM E185-82, as required by 10 CFR 50, Appendix H, through end-of-license (EOL) (32 EFPY), one additional surveillance capsule must be withdrawn. With consideration of 60 years of operation (50 EFPY), five total capsules must be withdrawn to satisfy ASTM E185-82 and to meet the recommendations of the Generic Aging Lessons Learned (GALL) Report, NUREG-1801, Revision 2. To satisfy the 5th capsule requirement, HBRSEP proposes to remove Capsule U after 41.3 EFPY, which corresponds to a fluence value of approximately 8.09×10^{19} n/cm^2 (projected maximum end-of-second license renewal (EOSLR) vessel fluence value). However, Capsule U must be withdrawn before 57.1 EFPY, which corresponds to a fluence value of approximately 1.18×10^{20} n/cm^2 (two times the projected maximum end-of-license extension (EOLE) vessel fluence value).

This withdrawal schedule is consistent with the recommendations of MRP-326 and WCAP-18215, "H.B. Robinson Unit 2 End-of-License Extension Reactor Vessel Integrity Evaluations and Feasibility Study," Table 7-2 (submitted as an attachment to the Duke Energy letter dated February 7, 2018 – Reference 9). The proposed revised withdrawal schedule is as follows:

Capsule	Effective Full Power Years
U (See Note 1)	41.3
Y (See Note 2)	Reserve
W (See Note 2)	Reserve

Note 1: Capsule to location 280° at Cycle 8. Capsule will reach a fluence of approximately 8.09×10^{19} n/cm^2 at approximately 41.3 EFPY. Thus, Capsule U should be withdrawn at 41.3 EFPY or during the scheduled outage after the 80-year peak vessel fluence is reached, but prior to 57.1 EFPY.

Note 2: Capsules Y was relocated to the 290° holder position and Capsule W was relocated to the 270° holder position during RO-27.

Upon NRC approval, the UFSAR will be updated to reflect this change.

5.0 TECHNICAL JUSTIFICATION

HBRSEP is currently licensed to operate for 60 years. HBRSEP entered the period of extended operation in August of 2010. NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Revision 2 provides guidance related to the reactor vessel surveillance program for renewed licenses. Section XI.M31, Item 4 states:

> "The plant-specific or integrated surveillance program shall have at least one capsule with a projected neutron fluence equal to or exceeding the 60-year peak reactor vessel wall neutron fluence prior to the end of the period of extended operation. The program withdraws one capsule at an outage in which the capsule receives a neutron fluence of between one and two times the peak reactor vessel wall neutron fluence at the end of the period of extended operation and tests the capsule in accordance with the requirements of ASTM E 185-82." and
>
> "Plant-specific and fleet operating experience should be considered in determining the withdrawal schedule for all capsules..."

The proposed withdrawal date for Capsule U meets these recommendations.

ASTM E-185-82, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels,” Section 7.6 provides the requirements for the number of surveillance capsules and withdrawal schedule. The standard requires a sufficient number of surveillance capsules be provided to monitor the effects of neutron irradiation on the reactor vessel throughout its operating lifetime and a withdrawal schedule to meet the monitoring requirements. The proposed revision to the surveillance capsule withdrawal schedule is to ensure that the remaining capsules accumulate sufficient fluence to meet the requirements of ASTM E 185-82.

The revised capsule withdrawal schedule is consistent with the recommendations of MRP-326, which considered HBRSEP and the U.S. PWR fleet. As discussed in MRP-326, surveillance data representative of the extended license fluence levels is desirable for both HBRSEP and the PWR fleet because that data can better inform future embrittlement trend curve development. The capsule fluence at the proposed withdrawal date will meet the GALL guidance that the license renewal capsule should achieve a fluence between one and two times the peak reactor vessel wall neutron fluence at the end of the period of extended operation.

The "GALL Report", Revision 2, is cited as it represents the latest guidance provided by the Staff. No request to revise the licensing basis of the HBRSEP renewed operating license is implied by this citation; it is offered only as a reference and objective evidence to support the Technical Justification for the deferral.

6.0 PRECEDENT

Similar requests for changes to a site-specific reactor vessel surveillance capsule schedule have been approved by the NRC. Although not an exhaustive industry listing, below are the Safety Evaluations (SE) reviewed as part of preparation of this request. Also included are the associated licensee letters that proposed the reactor vessel surveillance capsule schedule change.

1. Surry Power Station Units 1 and 2 (Dominion Energy):
   - Submittal dated July 28, 2017 (ADAMS Accession Nos. ML17213A080)
   - NRC SE dated December 10, 2018 (ADAMS Accession No. ML18318A062)
2. Watts Bar Nuclear Plant, Unit 2 (Tennessee Valley Authority):

- Submittal dated September 5, 2017 (ADAMS Accession Nos. ML17248A420)
- NRC SE dated November 20, 2017 (ADAMS Accession No. ML17312A260)

3. Arkansas Nuclear One, Unit 2 (Entergy):
   - Submittal dated September 14, 2017 (ADAMS Accession Nos. ML17257A121)
   - NRC SE dated June 27, 2018 (ADAMS Accession No. ML18173A019)
4. Beaver Valley, Unit 1 (FENOC):
   - Submittal dated October 6, 2017 (ADAMS Accession Nos. ML17284A195)
   - NRC SE dated July 2, 2018 (ADAMS Accession No. ML18164A082)

7.0 REFERENCES

1. American Society for Testing and Materials (ASTM) E-185-82, *Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels,* dated July 1, 1982.
2. 10 CFR 50 Appendix H, *Reactor Vessel Material Surveillance Program Requirements.*
3. 10 CFR 50.60, *Acceptance Criteria or Fracture Prevention Measures for Lightwater Nuclear Power Reactors for Normal Operation.*
4. NRC Administrative Letter 97-04, *NRC Staff Approval for Changes to 10 CFR 50, Appendix H, Reactor Vessel Surveillance Specimen Withdrawal Schedules,* dated September 30, 1997. (ADAMS Accession Number ML031210296)
5. Electric Power Research Institute technical report, *Materials Reliability Program: Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines (MRP-326),* dated 2011.
6. U.S. NRC, *Generic Aging Lessons Learned (GALL) Report, NUREG-1801, Revision 2*, December 2010. (ADAMS Accession Number ML103490041)
7. Duke Energy letter (RNP), *Revision to Reactor Vessel Surveillance Capsule Removal Schedule,* dated September 28, 2011 (ADAMS Accession No. ML11276A002).
8. NRC letter, *H. B. Robinson Steam Electric Plant, Unit No. 2 – Request for Revision to Reactor Vessel Material Surveillance Capsule Withdrawal Schedule (TAC No. ME7533)*, dated December 21, 2011 (ADAMS Accession No. ML11349A026)
9. Duke Energy letter (RNP), *License Amendment Request Proposing to Revise Technical Specification 3.4.3, "RCS Pressure and Temperature (P/T) Limits,* dated February 7, 2018 (ADAMS Accession No. ML18038B289)
10. NRC letter, *H. B. Robinson Steam Electric Plant, Unit No. 2 – Issuance of Amendment No. 260 Regarding Request to Revise Technical Specification Reactor Coolant System Pressure and Temperature Limits to Reflect 24-Month Fuel Cycles (EPID L-2017-LLA-0033)*, dated August 16, 2018 (ADAMS Accession No. ML18200A042)

ENCLOSURE 2

REGULATORY COMMITMENT

Subject: **REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE REMOVAL SCHEDULE**

The action in this document committed to by H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP), is identified in the following table. Statements in this submittal, with the exception of those in the table below, are provided for information purposes and are not considered Regulatory Commitments. Please direct any questions regarding this document or any associated regulatory commitments to Art Zaremba, Manager – Nuclear Fleet Licensing.

Item	Commitment
1	Capsule U will be withdrawn at 41.3 effective full-power years (EFPY) or during the scheduled outage after the 80-year peak vessel fluence is reached, but prior to 57.1 EFPY.