



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

June 13, 2013

Mr. Kevin Walsh, Site Vice President
c/o Michael O'Keefe
Seabrook Station
NextEra Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT 1 - REVISION TO REACTOR VESSEL
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (TAC NO. MF0669)

Dear Mr. Walsh:

By letter dated February 5, 2013, as supplemented by letter dated February 19, 2013, NextEra Energy Seabrook, LLC (NextEra) submitted a request to revise the withdrawal schedule for the reactor pressure vessel surveillance capsules for Seabrook Station, Unit 1. The purpose of NextEra's submittal is to incorporate the results of the last surveillance capsule to be analyzed while satisfying the requirements of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. Section III(B)(3) of Appendix H requires that proposed withdrawal schedules must be submitted and approved by the U.S. Nuclear Regulatory Commission (NRC) staff prior to implementation.

The NRC staff has reviewed the submittal and concludes that the proposed changes are acceptable and consistent with the intent and requirements of the applicable regulations and guidance found in Appendix H to 10 CFR Part 50, as well as the American Society for Testing and Materials Standard E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982. The NRC staff's related safety evaluation is enclosed.

Sincerely,

A handwritten signature in black ink, appearing to read "Veronica Rodriguez".

Veronica Rodriguez, Acting Chief
Plant Licensing Branch 1-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
Safety Evaluation

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated February 5, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML130420166), as supplemented by letter dated February 19, 2013 (ADAMS Accession No. ML13052A739), NextEra Energy Seabrook, LLC (NextEra or licensee) submitted a request to revise the withdrawal schedule for the reactor pressure vessel (RPV) surveillance capsules for Seabrook Station, Unit 1 (Seabrook). The purpose of the licensee's submittal was to incorporate the results of the last surveillance capsule (Capsule X) to be analyzed while satisfying the requirements of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. Section III(B)(3) of Appendix H requires that proposed withdrawal schedules must be submitted and approved by the U.S. Nuclear Regulatory Commission (NRC) staff prior to implementation.

The change will revise the schedule for one of the remaining capsules from approximately 21 effective full-power years (EFPY) to approximately 27 EFPY.

2.0 REGULATORY REQUIREMENTS

The RPV surveillance program for Seabrook was established in accordance with 10 CFR Part 50, Appendix H, which requires licensees to monitor changes in the fracture toughness properties of ferritic materials in the RPV beltline region of light-water nuclear power reactors. Appendix H states that the design of the RPV surveillance program and the surveillance capsule withdrawal schedule must meet the requirements of the edition of the American Society for Testing and Materials (ASTM) Standard E185, "Standard Practice for Conducting Surveillance Test for Light-Water Cooled Nuclear Power Reactor Vessels," that was current on the issue date of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) to which the RPV was purchased; however, the licensee may choose to use later editions through 1982 of the ASTM standard. The current surveillance program at Seabrook was developed in accordance with ASTM E185-82, as allowed by 10 CFR Part 50, Appendix H.

Enclosure

Section III(B)(3) of 10 CFR Part 50, Appendix H, requires that surveillance capsule withdrawal schedules be submitted to, and approved by, the NRC staff prior to implementation. NRC Administrative Letter 97-04, "NRC Staff Approval for Changes to 10 CFR Part 50, Appendix H, Reactor Vessel Surveillance Specimen Withdrawal Schedules," clarifies that applications conforming to the relevant version of ASTM E185 are not license amendment requests. Industry has developed a Coordinated Pressurized-Water Reactor (PWR) RPV Surveillance Program (CRVSP), which is documented in Materials Reliability Program (MRP), "Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines (MRP-326)." The purpose of the CRVSP is to increase the fluence levels of future surveillance capsules at withdrawal, while maintaining compliance with 10 CFR Part 50, Appendix H, and to ensure consistency with the guidance of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, December 2010 (the GALL Report). The CRVSP was designed to generate high fluence PWR surveillance data in support of extended life operations.

3.0 TECHNICAL EVALUATION

3.1 Summary Description of Licensee Evaluation

As discussed in the licensee's submittal, the revised withdrawal schedule for Capsule X is based on the recommendations for Seabrook in MRP-326 and incorporates the results of the analysis of Capsule V, which was removed from the Seabrook RPV in 2005 following 12.39 EFPY of operation. The analysis of Capsule V is documented in WCAP-16526, "Analysis of Capsule V from FPL Energy – Seabrook Unit 1 Reactor Vessel Radiation Surveillance Program," March 2006 (ADAMS Accession No. ML061030088). Consistent with the guidance in MRP-326, the licensee indicated that the revised withdrawal schedule for Capsule X was determined based on the most recent 55 EFPY neutron fluence projections for the RPV calculated in WCAP-17441-NP, "Seabrook Unit 1 Heatup and Cooldown Limit Curves for Normal Operation," October 2011 (ADAMS Accession No. ML12341A096).

The licensee's submittal dated February 5, 2013, provided the updated RPV surveillance capsule withdrawal schedule, which is summarized in Table 1 below. The licensee's proposed changes are shown in bold. It should be noted that Capsules U, Y, and V have already been withdrawn and tested in accordance with ASTM E185-82 specifications.

Table 1. Revised Surveillance Capsule Withdrawal Schedule for Seabrook

Capsule	Withdrawal EFPY	Lead Factor	Withdrawal Neutron Fluence (E > 1.0 MeV)
U	0.91	3.96	3.142×10^{18} n/cm ²
Y	5.57	3.74	1.292×10^{19} n/cm ²
V	12.39	3.78	2.669×10^{19} n/cm ²
X	27^A	4.11	6.140×10^{19} n/cm²
W	Standby ^B	4.10	^B
Z	Standby ^B	4.10	^B

^A Estimated removal of Capsule X is **27 EFPY, which is projected to occur at the end of Cycle 20**. Capsule X neutron fluence exposure is projected to approach a factor of 2 times the maximum projected RPV base metal neutron fluence at 55 EFPY.

^B Capsules W and Z are to be withdrawn within three cycles of the removal of Capsule X. Upon removal, Capsules W and Z are to be placed in storage. **All pulled and tested surveillance capsules, unless discarded before August 31, 2000, are to be placed in storage.**

Based on the capsule lead factors and the linear relationship between the peak RPV beltline fluence values and their corresponding EFPY values in WCAP-17441-NP, the operating period required for Capsule X to reach the new target neutron fluence of 6.140×10^{19} n/cm² (E > 1.0 MeV) was calculated to be 26.66 EFPY and rounded to 27 EFPY, as shown in Table 1 above. Assuming a 0.95 percent plant capacity factor starting in 2005, the licensee determined that Capsule X should reach the specified fluence at the end of cycle 20, which is projected to occur in 2020.

3.2 NRC Staff Evaluation

Table 1 of ASTM E185-82 specifies the minimum number of surveillance capsules that are to be removed from the RPV during the operating life of the plant, as well as the withdrawal sequence for the capsules. The number of capsules to be withdrawn and tested is based on the limiting reference nil ductility transition temperature (RT_{NDT}) shift (ΔRT_{NDT}) that is projected to occur at the RPV clad-to-base metal interface at the end-of-life (EOL) for the facility. Table 1 of ASTM E185-82 establishes the following criteria for determining the minimum number of capsules that are to be removed from the RPV:

- For plants with projected ΔRT_{NDT} less than 100 degrees Fahrenheit ($^{\circ}F$) (56 degrees Celsius ($^{\circ}C$)), a minimum of three capsules are required to be removed from the RPV during the operating life of the plant.
- For plants with projected ΔRT_{NDT} between 100 $^{\circ}F$ (56 $^{\circ}C$) and 200 $^{\circ}F$ (111 $^{\circ}C$), a minimum of four surveillance capsules are required to be removed from the RPV.
- For plants with projected ΔRT_{NDT} above 200 $^{\circ}F$ (111 $^{\circ}C$), a minimum of five surveillance capsules are required to be removed from the RPV.

In all cases, at least one capsule must be withdrawn at a capsule fluence of not less than once or greater than twice the peak EOL RPV fluence. The scheduled withdrawal time for this capsule may be modified on the basis of previous surveillance capsule tests, provided that any changes to the withdrawal schedule are submitted to the NRC for review and approval. Additional capsules not required to meet the ASTM E185-82 specification for the licensed operating term may be designated as "standby" capsules.

For the 40-year licensed operating period, the Seabrook RPV has a limiting ΔRT_{NDT} less than 100 $^{\circ}F$ (56 $^{\circ}C$) at the RPV clad-to-base metal interface, based on the latest RPV neutron fluence projections documented in WCAP-17441-NP. Therefore, the licensee is required to remove a minimum of three capsules from the Seabrook RPV for the 40-year licensed operating period. Three capsules (Capsules U, Y, V) have already been withdrawn from the RPV and tested, as shown in Table 1 above. The NRC staff compared the withdrawal conditions for Capsules U, Y, and V with the criteria of ASTM E185-82. The NRC staff confirmed that these previous capsule withdrawals are consistent with the criteria in Table 1 of ASTM E185-82 for the current 40-year license term.

The licensee has proposed revising the withdrawal schedule for the fourth capsule, Capsule X. Capsule X, which is currently scheduled for removal at 21 EFPY at the end of Cycle 16, will now be scheduled for removal at 27 EFPY, at the end of Cycle 20. The proposed revision will continue to satisfy the ASTM E185-82 requirement for removing a capsule with fluence between one and two times the peak projected EOL RPV fluence for a 60-year extended license term. Removing

the capsule at the new target fluence will provide valuable information in the higher fluence ranges, for which there is currently little operating experience or embrittlement data. This change makes no material difference to the current program for 40 years of operation, with regard to its compliance with ASTM E185-82 and 10 CFR Part 50, Appendix H, given that the previous withdrawal and testing of Capsules U, Y, and V satisfied the ASTM E185-82 requirements for 40 years. Therefore, the NRC staff determined that the proposed change to the surveillance capsule withdrawal schedule will continue to meet the requirements of ASTM E185-82, as required by 10 CFR Part 50, Appendix H.

The NRC staff notes that under the proposed withdrawal schedule, there will continue to be two standby surveillance capsules, Capsules W and Z. As indicated by Note B in the withdrawal schedule shown in Table 1, these standby capsules are to be withdrawn within three cycles of the removal of Capsule X and placed in storage. In addition, the proposed withdrawal schedule includes a new note stating that all pulled and tested capsules, unless discarded before August 31, 2000, are to be placed in storage. The NRC staff finds this additional note acceptable because the storage of all pulled and tested surveillance capsules (with the exception of those discarded before August 31, 2000) is a recommended element of the GALL Report RPV surveillance aging management program for plants that have been issued or that have applications pending for renewed operating licenses.

The NRC staff finds that the proposed revisions to the Seabrook surveillance capsule withdrawal schedule satisfy the requirements of 10 CFR Part 50, Appendix H and ASTM E185-82. Within this context, the withdrawal and testing of Capsule X at the higher fluence is both acceptable and prudent. Therefore, the licensee's proposed changes are acceptable for implementation.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the revised surveillance capsule withdrawal schedule and associated actions for Seabrook satisfy the requirements of ASTM E185-82, as they relate to the current 40-year operating period. Therefore, the NRC staff concludes that the licensee's modified surveillance capsule withdrawal schedule for Seabrook is acceptable for implementation and satisfies the requirements of Appendix H to 10 CFR Part 50 for the current 40-year license term.

The NRC staff notes that this review does not affirm or support the propriety of the revised withdrawal schedule within the context of the proposed extended license period. The licensee is expected to ensure that it is in compliance with all applicable license renewal requirements concerning its RPV material surveillance program for the proposed 60-year extended operating license.

Principal Contributor: C. Sydnor

Date: June 13, 2013

Mr. Kevin Walsh, Site Vice President
c/o Michael O'Keefe
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Seabrook, NH 03874

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The NRC staff has reviewed the submittal and concludes that the proposed changes are acceptable and consistent with the intent and requirements of the applicable regulations and guidance found in Appendix H to 10 CFR Part 50, as well as the American Society for Testing and Materials Standard E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982. The NRC staff's related safety evaluation is enclosed.

Sincerely,

/RA/

Veronica Rodriguez, Acting Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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ADAMS ACCESSION NO.: ML13050A138 *Via memo dated June 7, 2013

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