



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

September 4, 2013

Mr. Mano Nazar
Executive Vice President
and Chief Nuclear Officer
NextEra Energy
P. O. Box 14000
Juno Beach, FL 33408-0420

SUBJECT: TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4 – REVIEW OF REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM – REVISED SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (TAC NOS. ME9564 AND ME9565)

Dear Mr. Nazar:

By letter dated September 14, 2012, as supplemented by letter dated August 13, 2013, Florida Power & Light Company (the licensee) requested U.S. Nuclear Regulatory Commission (NRC) review and approval of a revision to the reactor pressure vessel integrated surveillance capsule removal schedule for Turkey Point Nuclear Generating Unit Nos. 3 and 4. The licensee revised a calculation that affected the Capsule X₄ withdrawal schedule. Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR Part 50), Appendix H, Section III.B.3 requires proposed withdrawal schedules to be submitted to and approved by the NRC prior to implementation.

The NRC staff reviewed the licensee's submittals and concludes that the revised surveillance capsule withdrawal schedule for Turkey Point Nuclear Generating Unit Nos. 3 and 4 is acceptable for implementation and satisfies the requirements of Appendix H to 10 CFR Part 50 for the 60-year extended license term. The NRC's safety evaluation is enclosed.

Please contact Audrey Klett at (301) 415-0489 if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Farideh E. Saba".

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR GENERATING UNITS 3 AND 4
RENEWED FACILITY OPERATING LICENSE NOS. DPR-31 AND DPR-41
DOCKET NOS. 50-250 AND 50-251

1.0 INTRODUCTION

By letter dated September 14, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12262A287), as supplemented by letter dated August 13, 2013, Florida Power & Light Company (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for its review and approval of a revision to the reactor pressure vessel (RPV) integrated surveillance capsule removal schedule for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point 3 and 4). Pursuant to Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR Part 50), Appendix H, "Reactor Vessel Material Surveillance Program Requirements," the licensee proposed to revise the scheduled withdrawal time for Surveillance Capsule X₄ (Capsule X₄), which the NRC previously found acceptable in its safety evaluation for the extended power uprate (EPU) approved in License Amendment Nos. 249 and 245 (ADAMS Accession No. ML11293A365). In its letter dated August 13, 2013, the licensee clarified that it was requesting NRC's review pursuant to 10 CFR Part 50, Appendix H, Section III.B.3. Section III.B.3 of 10 CFR Part 50, Appendix H requires proposed withdrawal schedules to be submitted to and approved by the NRC prior to implementation. The licensee stated in its submittal that it revised a calculation that changed the Capsule X₄ withdrawal schedule from 35.8 effective full-power years (EFPY) to 38.1 EFPY.

2.0 REGULATORY EVALUATION

The RPV material surveillance program for Turkey Point 3 and 4 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 surveillance program and the 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 to which the RPV was purchased; however, the licensee may choose to use later editions through 1982 of the

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ASTM standard. The current surveillance program at Turkey Point 3 and 4 was developed in accordance with ASTM E185-82, as allowed by 10 CFR Part 50, Appendix H.

Section III.B.3 of 10 CFR Part 50, Appendix H requires proposed surveillance capsule withdrawal schedules to 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 the Electric Power Research Institute Materials Reliability Program (MRP) technical report, "Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines (MRP-326)," dated December 2011 (ADAMS Accession Nos. ML12040A314 and ML12040A315). The purpose of the CRVSP is to increase the neutron fluence levels of future surveillance capsules at withdrawal while maintaining compliance with 10 CFR Part 50, Appendix H and consistency with the guidance of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, dated December 2010 (i.e., the GALL Report, ADAMS Accession No. ML103490041). 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

The licensee proposed to change the scheduled withdrawal time for Capsule X₄ from 35.8 EFPY, which corresponds to a capsule neutron fluence of 8.140×10^{19} neutrons per square centimeters (n/cm^2) (energy (E) > 1.0 megaelectron volt (MeV)), to 38.1 EFPY, which corresponds to a capsule neutron fluence of 9.297×10^{19} n/cm^2 (E > 1.0 MeV). As discussed in the licensee's submittal, the revised withdrawal schedule for Capsule X₄ is based on the recommendations for Turkey Point 3 and 4 in MRP-326. The licensee indicated that the revised withdrawal schedule for Capsule X₄ takes into consideration EPU operating conditions.

The licensee's September 14, 2012, submittal provided the updated RPV surveillance capsule withdrawal schedule, as summarized in Table 1 of this safety evaluation. The licensee's proposed changes are shown in bold. It should be noted that Capsules T₃, T₄, S₃, S₄, V₃, and X₃ have already been withdrawn and tested in accordance with ASTM E185-82 specifications for the original 40-year licensed operating period. The licensee indicated that Capsule X₄ is the last capsule scheduled for removal from the RPV under the Turkey Point 3 and 4 surveillance program for the 60-year extended license term.

Table 1: Revised Surveillance Capsule Withdrawal Schedule for Turkey Point 3 and 4

Capsule	Withdrawal EFPY	Lead Factor	Withdrawal Neutron Fluence (E > 1.0 MeV)
T ₃	1.15	2.736	0.599 x 10 ¹⁹ n/cm ²
T ₄	1.17	2.740	0.649 x 10 ¹⁹ n/cm ²
S ₃	3.46	1.997	1.272 x 10 ¹⁹ n/cm ²
S ₄	3.41	2.030	1.290 x 10 ¹⁹ n/cm ²
V ₃	8.06	0.891	1.223 x 10 ¹⁹ n/cm ²
X ₃	19.85	1.129	2.897 x 10 ¹⁹ n/cm ²
X₄	38.1^A	2.088	9.297 x 10¹⁹ n/cm²
V ₄	Standby ^B	1.015	---
U ₃	Standby ^B	0.767	---
U ₄	Standby ^B	0.767	---
W ₃	Standby ^B	0.523	---
W ₄	Standby ^B	0.523	---
Y ₃	Standby ^B	0.767	---
Y ₄	Standby ^B	0.767	---
Z ₃	Standby ^B	0.523	---
Z ₄	Standby ^B	0.523	---

^A Capsule X₄ removal time is revised to 38.1 EFPY, which will ensure that the capsule accumulates a neutron fluence approximately equivalent to the projected 80-year (67 EFPY) peak RPV neutron fluence of 9.297 x 10¹⁹ n/cm² (E > 1.0 MeV).

^B Capsules V₄, U₃, U₄, W₃, W₄, Y₃, Y₄, Z₃, and Z₄ are all designated as standby capsules and are not currently scheduled to be withdrawn from the Turkey Point 3 and 4 RPVs during the 60-year licensed operating period.

3.2 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 (°F) (56 degrees Celsius (°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 °F (56 °C) and 200 °F (111 °C), a minimum of four surveillance capsules are required to be removed from the RPV.
- For plants with projected ΔRT_{NDT} above 200 °F (111 °C), a minimum of five surveillance capsules are required to be removed from the RPV.

In all cases, ASTM E185-82 specifies that at least one capsule must be withdrawn at a capsule neutron fluence of not less than once or greater than twice the peak EOL RPV neutron fluence. The scheduled withdrawal time for this capsule may be modified based on 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 60-year licensed operating period, the Turkey Point 3 and 4 RPVs have a limiting ΔRT_{NDT} greater than 200 °F (56 °C) at the RPV clad-to-base metal interface, based on the latest RPV neutron fluence projections identified for the EPU approved in License Amendment Nos. 249 and 245. Therefore, the licensee is required to remove a minimum of five capsules from the Turkey Point 3 and 4 RPVs for the 60-year licensed operating period. By letter dated April 22, 1985 (ADAMS Accession No. ML013370393), the NRC issued License Amendment Nos. 112 and 106 to Turkey Point 3 and 4 respectively, which authorized the implementation of an integrated surveillance program (ISP) for Turkey Point 3 and 4. The Turkey Point 3 and 4 ISP permits the five required capsule withdrawals to be covered between the two units, since each unit shares the same heat (i.e., continuous production run) of representative plate and weld material in their surveillance capsules. As shown in Table 1, Capsules T₃, T₄, S₃, S₄, V₃, and X₃ have already been withdrawn and tested in accordance with ASTM E185-82 specifications for the original 40-year licensed operating period. For the 60-year extended licensed operating period, Capsule X₄ is required to satisfy the requirement for withdrawing a capsule when the capsule neutron fluence is not less than once or greater than twice the peak EOL RPV neutron fluence.

The licensee proposed revising the withdrawal schedule for Capsule X₄. Capsule X₄, which is currently scheduled for removal at 35.8 EFPY, will now be scheduled for removal at 38.1 EFPY. Based on the Capsule X₄ lead factor and the linear relationship between the peak RPV beltline fluence values and their corresponding EFPY values, the staff confirmed that a 38.1 EFPY operating period corresponds to the new target neutron fluence of 9.297×10^{19} n/cm² (E > 1.0 MeV). The staff also confirmed, based on the Capsule X₄ lead factor, that the new target neutron fluence for this capsule is approximately equivalent to the projected 80-year (67 EFPY) peak RPV neutron fluence, considering EPU conditions. Therefore, the proposed revision will continue to satisfy the ASTM E185-82 requirement for removing a capsule with neutron fluence between one and two times the peak projected EOL RPV neutron 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 does not in any way affect the surveillance program with regard to its compliance with ASTM E185-82 and 10 CFR Part 50, Appendix H for 60 years of operation. Therefore, the 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 nine standby surveillance capsules, as shown in Table 1 of this safety evaluation. These standby capsules are not required to satisfy the ASTM E185-82 and 10 CFR Part 50, Appendix H requirements for the 60-year extended license term. The lead factors for these standby capsules are all less than or equal to 1.015, which indicates that the neutron fluence for these capsules will not significantly exceed the projected RPV beltline neutron fluence, provided that the capsules remain in their current locations. Therefore, continued operation of the Turkey Point 3 and 4 RPVs with the standby capsules remaining in place is warranted because these capsules will not accumulate excessive neutron fluence relative to the RPV beltline region

during the 60-year operating term. Continued implementation of surveillance program with these standby capsules in the RPVs is acceptable.

The staff finds that the proposed revisions to the Turkey Point 3 and 4 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 X₄ at the higher neutron fluence is both acceptable and prudent. Therefore, the licensee's proposed changes are acceptable for implementation.

4.0 CONCLUSION

Based on the aforesaid evaluation, the NRC staff concludes that the revised surveillance capsule withdrawal schedule for Turkey Point 3 and 4 satisfies the requirements of ASTM E185-82, as they relate to the 60-year extended operating period. Therefore, the NRC staff concludes that the licensee's modified surveillance capsule withdrawal schedule for Turkey Point 3 and 4 satisfies the requirements of Appendix H to 10 CFR Part 50 for the 60-year extended license term and is acceptable for implementation.

Principal Contributor: Christopher Sydnor

Date: September 4, 2013

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Please contact Audrey Klett at (301) 415-0489 if you have any questions.

Sincerely,
/RA/
Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
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Docket Nos. 50-250 and 50-251

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***by memorandum**

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