



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

January 14, 2014

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 – SAFETY EVALUATION
RE: REVISION TO THE REACTOR VESSEL SURVEILLANCE CAPSULE
WITHDRAWAL SCHEDULE PER 10 CFR 50 APPENDIX H (TAC NO. MF2558)

Dear Sir or Madam:

By letter dated August 12, 2013, Entergy Nuclear Operations, Inc., the licensee, requested approval of proposed changes to the reactor vessel surveillance capsule withdrawal schedule for the Indian Point Nuclear Generating Unit No. 2. The proposed changes were submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," Section III.B.3, which requires that proposed withdrawal schedules be submitted and approved by the Nuclear Regulatory Commission (NRC) prior to implementation.

The NRC staff concludes that the proposed changes to the reactor pressure vessel surveillance capsule withdrawal schedule are consistent with the recommendations specified in American Society for Testing and Materials Standard Practice E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," as referenced by the requirements of 10 CFR Part 50, Appendix H. Furthermore, the proposed changes meet the guidance in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 1, Section XI.M31. Therefore, the proposed changes are acceptable. The NRC staff's evaluation is enclosed.

Sincerely,

A handwritten signature in black ink, reading "Benjamin G. Beasley".

Benjamin G. Beasley, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-247

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE REACTOR VESSEL MATERIALS SURVEILLANCE PROGRAM

ENTERGY NUCLEAR OPERATIONS, INC

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

DOCKET NO. 50-247

1.0 INTRODUCTION

By letter dated August 12, 2013 (Agencywide Document Access and Management System Accession No. ML13043A659), Entergy Nuclear Operations, Inc. (Entergy, the licensee), requested approval of a revision to the reactor vessel (RV) surveillance specimen withdrawal schedule for Indian Point Nuclear Generating Unit No. 2 (IP2). The letter proposes to change the surveillance capsule withdrawal schedule to cover the additional twenty year period of extended operation (PEO).

2.0 REGULATORY EVALUATION

2.1 Section 50.60 of Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.60) and Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50

The Nuclear Regulatory Commission (NRC) has established requirements and criteria in 10 CFR 50.60 for protecting the RVs of U.S. light-water reactors (LWRs) against fracture. The rule requires U.S. LWRs to meet the RV materials surveillance program requirements set forth in Appendix H to 10 CFR Part 50.

Appendix H to 10 CFR Part 50 provides the NRC staff's criteria for the design and implementation of RV material surveillance programs for operating LWRs. The rule, in part, requires RV surveillance program designs and withdrawal schedules to meet the requirements of the edition of American Society for Testing and Materials (ASTM) Standard Practice E185, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels" that is current on the issue date of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* to which the RV was purchased, although later editions of ASTM E185 may be used inclusive of the 1982 Edition of ASTM E185 (ASTM E185-82). The rule also requires proposed RV surveillance programs to be submitted to the NRC and approved prior to implementation. The applicable criteria in ASTM E185-82 are discussed in the Section 3.1 of this safety evaluation.

Enclosure

2.2 NRC Administrative Letter (AL) 97-004 and NRC Memorandum and Order CLI-96-13

On September 30, 1997, the NRC issued AL 97-004 to all holders of operating licenses for domestic nuclear power plants (with the exception of those who have ceased operations of their facilities or have certified that fuel has been permanently removed from the reactor). In this AL, the NRC staff summarized the Commission's decision promulgated in Commission Memorandum and Order CLI-96-13, which was issued "In the Matter of the Cleveland Electric Illuminating Company (Perry Nuclear Power Plant, Unit 1)" on December 6, 1996. In this Memorandum and Order, the Commission found that, while 10 CFR Part 50, Appendix H, II.B.3 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 process (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 (ASTM E-185,) 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 staff document its review and verification of such conformance.

2.3 GALL Guidelines

On April 30, 2007, the licensee applied for an additional twenty year PEO based on NUREG-1801, *Generic Aging Lessons Learned Report*, Revision 1 (GALL). Section XI.M31 of the GALL includes recommended changes to the surveillance capsule withdrawal schedule that depends on whether the existing program includes a capsule that bounds the projected maximum fluence for the additional twenty year PEO. At IP2, no capsule has been pulled that would bound the fluence for the PEO, therefore, GALL would allow the licensee to delay withdrawal and testing of the final capsule until the fluence exceeds the projected maximum fluence for the additional twenty year PEO.

3.0 TECHNICAL EVALUATION

3.1 Evaluation Criteria of ASTM Standard Practice E185-82

For IP2, Entergy is applying the requirements of ASTM E185-82 as its basis for meeting the RV surveillance capsule withdrawal requirements of 10 CFR Part 50, Appendix H. Table 1 of ASTM E185-82 requires that either a minimum of three, four, or five surveillance capsules be removed from the RVs, based on the limiting amount of RT_{NDT} shift (limiting ΔRT_{NDT}) that is projected to occur at the clad-vessel interface location of the RV at the end-of-licensed plant life (EOL). ASTM E185-82 establishes the following criteria for determining the minimum number of capsules that are to be removed in accordance with a withdrawal schedule and the number of capsules that are to be tested:

1. For plants with projected RT_{NDT} shifts (i.e., ΔRT_{NDT}) less than 100°F (56°C), three capsules are required to be removed from the RV and the first two capsules are required to be tested (for dosimetry, tensile-ductility, Charpy-V impact toughness, and alloying chemistry).
2. For plants with projected ΔRT_{NDT} between 100°F (56°C) and 200°F (111°C), four surveillance capsules are to be removed from the RV and the first three capsules are required to be tested.

3. For plants with projected ΔRT_{NDT} above 200°F (111°C), five surveillance capsules are required to be removed from the RV and the first four capsules are required to be tested.
4. ASTM E185-82 permits the last scheduled surveillance capsules in three, four, or five capsule withdrawal schedules to be removed and held without the implementation of testing.

ASTM E185-82 also provides specific criteria for removal of surveillance capsules. The removal times are based on criteria that the surveillance capsules be removed after a certain amount of power operation has elapsed or at various times when the RV shell is projected to achieve certain levels of neutron fluence. The intent of the Standard Practice is to achieve a set of testing data over a range of neutron fluences for the RV that bounds the current life of the plant. Of key importance are the removal criteria for the second to last and final capsules required for capsule withdrawal. For the second-to-last required capsule in a withdrawal schedule, ASTM E185-82 requires that the capsules be pulled at either 15 effective full-power years (EFPYs) or at the time when the capsule is equivalent to the limiting fluence projected for the clad-based metal interface of the RV at EOL, whichever time comes first. For the final capsule that is required for removal, ASTM E185-82 requires that the capsule be removed at a time when the neutron fluence projected for the capsule is between the limiting fluence value projected for the RVs at the EOL and two times that value.

With respect to the PEO, the IP2 RV has a limiting ΔRT_{NDT} value greater than 200 °F. As stated above, since the ΔRT_{NDT} value is greater than 200 °F, ASTM E185-82 requires that the licensee, at a minimum, remove five capsules from the reactor during the licensed operating period and test the first four capsules. The licensee has already removed and tested four capsules.

3.2 Changes Proposed to the Withdrawal Schedule for IP2

The licensee's August 12, 2013, letter provides the proposed new RV surveillance capsule withdrawal schedule for IP2. The letter indicated that Capsules T, Y, Z, and V were removed from IP2 at 1.42 EFPY, 2.34 EFPY, 5.17 EFPY, and 8.6 EFPY, respectively, and that the neutron fluences reported for capsules T, Y, Z, and V at the time of withdrawal are 2.53×10^{18} n/cm², 4.55×10^{18} n/cm², 1.02×10^{19} n/cm², and 4.92×10^{18} n/cm², respectively, as reported in Westinghouse letter IPP-01-079, dated April 26, 2001. Note that the fluences did not necessarily increase with increasing EFPY because the lead factors varied from capsule to capsule.

The licensee indicated in its August 12, 2013, letter that in addition to the four capsules that have already been withdrawn and tested, that one additional capsule (Capsule W) will be removed from the IP2 RV at the end of refueling cycle 28 (after the start of the PEO), at a projected fluence of 105 percent of the projected maximum fluence at the cladding/base metal interface. The licensee also indicated that it has two spare capsules (Capsule U and X). The licensee noted that the withdrawal schedule for the three capsules, Capsules U, W, and X, are interchangeable, due to the common lead factor and the common materials in the capsules.

The limiting neutron fluence projected for the IP2 RV is approximately 1.906×10^{19} n/cm² at PEO (48 EFPY). Capsules T, Y, Z, and V have been withdrawn and tested. The current withdrawal schedule was established based on the 1979 Edition of the Standard Practice (ASTM E185-79).

The NRC staff verified that the four capsules that have been withdrawn to date, do comply with the withdrawal schedule of ASTM E185-79. The licensee's proposed change to the surveillance capsule withdrawal schedule is based on the requirements of the ASTM E185-82, to the extent practicable, as required by Appendix H to 10 CFR Part 50.

The licensee indicated that the projected neutron fluence for Capsule W at the time of removal (42 EFPY) will be 2.0×10^{19} n/cm² and that the lead factor for the capsule is 1.2. In addition, the licensee indicated that it has two spare capsules with the same lead factor, Capsules U and X, included in its RV surveillance capsule withdrawal program. Given the same assumptions that the licensee used to estimate the 42 EFPY fluence for Capsule W, the staff projects a fluence of 2.74×10^{19} n/cm² at 48 EFPY for the spare capsules.

As stated above, ASTM E185-82 requires that the 4th capsule be pulled at either 15 EFPY or at the time when the capsule is equivalent to the limiting fluence projected for the clad-based metal interface of the RV at EOL, whichever time comes first. However, the intent of the Standard Practice is to achieve a set of testing data over a range of neutron fluences for the RV that bounds the current life of the plant. The NRC staff has determined that the intent of the requirements for the 4th capsule will be met by the proposed schedule if the license is renewed. Furthermore, the NRC staff notes that either Capsule U or X at 48 EFPY will meet the ASTM E185-82 guidelines for the 5th capsule if the license is renewed for an additional 20 years. The two spare capsules do not need to be withdrawn from the RV because the projected fluence at the end of the PEO is less than 2x the maximum projected fluence for the RV. Therefore, the NRC staff finds that the proposed new withdrawal schedule will adequately meet the ASTM E185-82 guidelines for its surveillance capsule withdrawal program if license renewal is granted.

With respect to the GALL Report guidance, the NRC staff finds the change in the withdrawal schedule for Capsule W from "End of Life" to "End of Cycle 28" is consistent with GALL because Capsule W at the end of refueling cycle 28 will have about 105 percent of the projected maximum fluence for the additional twenty year PEO.

4.0 CONCLUSION

The NRC staff has reviewed Entergy's proposed withdrawal schedules for IP2 and has determined that the changes to the schedule will continue to meet the RV surveillance capsule withdrawal schedule criteria in ASTM E185-82, and will be in compliance with 10 CFR Part 50, Appendix H, if IP2 is granted an additional twenty year period of operation. The staff, therefore, concludes that the RV withdrawal schedule, as proposed in the licensee's August 12, 2013, letter is acceptable for implementation.

Principal Contributor: Patrick Purtscher

Date: January 14, 2014

January 14, 2014

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
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Sincerely,

/ra/

Benjamin G. Beasley, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
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Enclosure:
Safety Evaluation

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***via memorandum**

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