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

November 13, 2012

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. 3 - REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (TAC NO. ME9032)

Dear Sir or Madam:

By letter dated July 10, 2012, Entergy Nuclear Operations, Inc., the licensee, submitted a request to revise the withdrawal schedule for the reactor pressure vessel surveillance capsules for Indian Point Nuclear Generating, Unit No. 3. The purpose of the licensee's submittal was 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 to 10 CFR Part 50 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 American Society for Testing and Materials (ASTM) Standard E185-82. The staff's related safety evaluation is enclosed.

Sincerely,

George A. Wilson, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-286

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

DOCKET NO. 50-286

1.0 INTRODUCTION

By letter dated July 10, 2012 (Agencywide Documents Access and Management System Accession No. ML12202A012), Entergy Nuclear Operations, Inc. (Entergy, the licensee) submitted a request to revise the withdrawal schedule for the reactor pressure vessel (RPV) surveillance capsules for Indian Point Nuclear Generating, Unit No. 3 (IP3). 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 to 10 CFR Part 50 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 end of life (EOL) capsules from approximately 25.5 effective full power years (EFPY) to approximately 29.0 EFPY.

2.0 REGULATORY REQUIREMENTS

The surveillance program for IP3 was established in accordance with Appendix H to 10 CFR Part 50 that requires licensees to monitor changes in the 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 (ASME B&PV) 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 IP3 was developed in accordance with ASTM E185-82, as allowed by 10 CFR Part 50, Appendix H.

Section III(B)(3) of Appendix H to 10 CFR Part 50 requires that proposed withdrawal schedules must be submitted and approved by the NRC staff prior to implementation. NRC Administrative Letter 97-04, "NRC Staff Approval for Changes to 10 CFR 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.

3.0 TECHNICAL EVALUATION

The current capsule withdrawal schedule as described in the IP3 Updated Final Safety Analysis Report is based on the Capsule Z analysis. Capsule Z was removed from the IP3 reactor core in 1987 following 5.55 EFPY of operation. The proposed change to the withdrawal schedule for the remaining capsules will incorporate the results of the Capsule X analysis documented in WCAP-16251, "Analysis of Capsule X from Entergy's Indian Point 3 Reactor Vessel Radiation Surveillance Program." Capsule X was removed from the IP reactor core in 2003 following 15.6 EFPY of operation.

The proposed change to the surveillance capsule schedule is based on the requirements of the 1982 Edition of ASTM E185, to the extent practicable as provided in 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 each of the vessels, as based on the limiting amount of reference temperature nil ductility transition (RT_{NDT}) shift (ΔRT_{NDT}) that is projected to occur at the clad-vessel interface location of the RPV at the 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:

- For plants with projected ΔRT_{NDT} less than 100 degrees Fahrenheit ($^{\circ}F$) (56 (degrees Celsius ($^{\circ}C$)), three capsules are required to be removed from the RPV and the first two capsules are required to be tested (for dosimetry, tensile-ductility, Charpy-V impact toughness, and alloying chemistry).

- For plants with projected ΔRT_{NDT} between 100 $^{\circ}F$ (56 $^{\circ}C$) and 200 $^{\circ}F$ (111 $^{\circ}C$), four surveillance capsules are to be removed from the RPV and the first three capsules are required to be tested.

- For plants with projected ΔRT_{NDT} above 200 $^{\circ}F$ (111 $^{\circ}C$), five surveillance capsules are required to be removed from the RPV and the first four capsules are required to be tested.

For the 40-year license period of operation, the licensee states that the IP3 RPV has a limiting ΔRT_{NDT} greater than 200 $^{\circ}F$ (111 $^{\circ}C$). Therefore, the licensee was required to remove a minimum of five capsules from IP3 during the 40-year period of operation.

Four capsules have already been withdrawn and tested from the reactor (representing a fluence received between 2.6×10^{18} and 8.7×10^{18} n/cm^2, E > 1 MeV) fulfilling the testing requirements for the license period. The licensee has proposed an alternative withdrawal schedule for the fifth capsule that will satisfy the ASTM E185-82 requirement for removing a capsule with fluence between one and two times the EOL estimated vessel fluence. This change makes no material difference to the current program while potentially providing test-data more useful in a fleet-wide

context. Capsule U, which is the next capsule to be removed and was scheduled for removal following 25.5 EFPY, will now be scheduled for removal following 29.0 EFPY.

The NRC staff notes that under the proposed withdrawal schedule, there will be two standby surveillance capsules, Capsules V and W, remaining for IP3 that have the potential of being removed for storage or used for future testing.

The licensee's letter dated July 10, 2012, provides the updated history of the RPV surveillance capsules for IP3 as summarized in Table 1 below.

Table 1. Summary of Surveillance Capsule Withdrawal at IP3.

ID	Withdrawal EFPY	Withdrawal Neutron Fluence (E > 1.0 MeV)
T	1.4	2.63×10^{18} n/cm^2
Y	3.2	6.92×10^{18} n/cm^2
Z	5.5	1.04×10^{19} n/cm^2
S	NA	NA
X	15.5	8.74×10^{18} n/cm^2
U	25.5-29.0[A]	$9.22 \times 10^{18} - 2.96 \times 10^{19}$ n/cm^2 [B]

[A] Target removal EFPY mediated by refueling schedule, to occur at EOL or 29 EFPY
[B] Estimated fluence at end of license or 29 EFPY

The licensee proposes to remove Capsule U either at the end of the current license or as close as possible to 29 EFPY, circa 2019, when the capsule will have been exposed to a total neutron fluence of ~1.5-3 x 10^{19} n/cm^2 (E > 1.0 MeV). Removing the capsule at this target fluence will provide valuable information in the higher fluence ranges, for which there is currently little experience or data.

The NRC staff compared the withdrawal conditions for IP3 surveillance capsules T, Y, Z, X, and U with the criteria of ASTM E185-82. The staff confirmed that the withdrawals were consistent with the criteria in ASTM E185-82 for the proposed withdrawal schedule.

The NRC staff concludes that the proposed change in withdrawal schedule adequately addresses the requirements and recommendations of Appendix H and ASME E185-82. Within this context, the testing of an IP3 capsule with a higher fluence is both acceptable and prudent. The staff further concludes that the licensee has adequately addressed all concerns, limitations, and commitments related to this request.

4.0 CONCLUSION

Based on the above, the NRC staff finds that the revised surveillance capsule withdrawal schedule and associated actions for IP3 satisfy the requirements and recommendations of ASTM E185-82 as pertinent to the application. Therefore, the staff concludes that the licensee's modified surveillance capsule withdrawal schedule for IP3 is acceptable for implementation and satisfies the requirements of Appendix H to 10 CFR Part 50.

The NRC staff notes that this review does not affirm or support the propriety of the revised withdrawal schedule within the context of an extended license period. The licensee is expected to ensure that it is in compliance with all pertinent license renewal factors concerning its surveillance capsule program.

Principal Contributor: Dan Widrevitz

Date: November 13, 2012

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Entergy Nuclear Operations, Inc.
Indian Point Energy Center
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P.O. Box 249
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/RA/
George A. Wilson, Chief
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