

Submitted: August 10, 2015

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August 12, 2013

NL-13-106

U.S. Nuclear Regulatory Commission  
 ATTN: Document Control Desk  
 11545 Rockville Pike, TWFN-2 F1  
 Rockville, MD 20852-2738

**SUBJECT:** Proposed Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule  
 Per 10 CFR 50 Appendix H  
 Indian Point Unit Number 2  
 Docket No. 50-247  
 License No. DPR-26


- REFERENCES:**
1. NRC Administrative Letter 97-04, "NRC Staff Approval For Changes to 10 CFR 50, Appendix H, Reactor Vessel Surveillance Specimen"
  2. ASTM Standard E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels".

Dear Sir or Madam:

Entergy Nuclear Operations, Inc. (Entergy) hereby requests NRC approval of a revision to the reactor vessel surveillance capsule withdrawal schedule pursuant to 10 CFR 50, Appendix H, Section III.B.3 which requires that withdrawal schedules be submitted in accordance with 10 CFR 50.4 and that the proposed schedule must be approved by the NRC prior to implementation.

Reference 1 allows NRC approval of the proposed changes to the withdrawal schedule without a license amendment if the changes conform with the American Society for Testing and Materials (ASTM) Standard Practice E 185-82 (Reference 2). The proposed changes comply with the recommendations of ASTM Standard Practice E 1985-82 as discussed in Attachment 1.

Indian Point Unit 2 applied for a twenty year extension to the current operating license which is still under review. This letter proposes to change the surveillance capsule withdrawal schedule to cover the additional twenty year period of extended operation. As a result of this change, Entergy proposes to revise the withdrawal date for the next capsule from "the end of life" to refueling outage 28, currently scheduled for March 2028. This is consistent with the requirements of ASTM E 185-82 for a sixty year operating period. Additional details are provided in Attachment 1.

United States Nuclear Regulatory Commission Official Hearing Exhibit	
<b>In the Matter of:</b>	Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)
	<b>ASLBP #:</b> 07-858-03-LR-BD01
	<b>Docket #:</b> 05000247   05000286
	<b>Exhibit #:</b> ENT000670-00-BD01
	<b>Admitted:</b> 11/5/2015
	<b>Rejected:</b>
<b>Other:</b>	
	<b>Identified:</b> 11/5/2015
	<b>Withdrawn:</b>
	<b>Stricken:</b>

current operating license and none of the remaining capsules available for retrieval will have accumulated sufficient fluence to meet the ASTM E 185-82 requirements for a fifth capsule when considering the additional 20 years of operation. There are no new commitments being made in this submittal. If you have any questions or require additional information, please contact Mr. Robert Walpole, IPEC Licensing Manager at (914) 254-6710.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 12, 2013.

Sincerely,



JAV/sp

Attachments: Proposed Revision to Reactor Vessel Surveillance Capsule Withdrawal  
Schedule Per 10 CFR 50 Appendix H

cc: Mr. Douglas Pickett, Senior Project Manager, NRC NRR DORL  
Mr. William Dean, Regional Administrator, NRC Region 1  
NRC Resident Inspector  
Mr. Francis J. Murray, Jr., President and CEO, NYSERDA  
Ms. Bridget Frymire, New York State Dept. of Public Service

ATTACHMENT 1 TO NL-13-106

PROPOSED REVISION TO REACTOR VESSEL SURVEILLANCE  
CAPSULE WITHDRAWAL SCHEDULE PER 10 CFR 50 APPENDIX H

ENERGY NUCLEAR OPERATIONS, INC.  
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2  
DOCKET NO. 50-247

## 1.0 REQUIREMENTS

Appendix H of 10 CFR 50 (Reference 1) describes reactor vessel material surveillance program requirements. Paragraph (III)(B)(3) requires "A proposed withdrawal schedule must be submitted with a technical justification as specified in Section 50.4. The schedule must be approved prior to implementation." Reference 2 allows NRC approval of the proposed changes to the withdrawal schedule without a license amendment if the changes conform with the American Society for Testing and Materials (ASTM) standard E 185 (Reference 3).

## 2.0 PROPOSED CHANGES

The proposed change revises the withdrawal schedule for one of the surveillance capsules which remain in the reactor vessel by revising the withdrawal date from the end of life to RFO 28 currently scheduled for March 2028. It also makes an administrative change to delete the Capsule S note since the 2RFO19 is past. The current schedule and proposed changes are identified in Tables 1 and 2, respectively.

The current surveillance capsule withdrawal was submitted by Entergy in references 5 and 6 and it was approved by the NRC in reference 7.

Table 1 - Current Withdrawal Schedule

Capsule	Location	Lead Factor	Withdrawal Date
T	320°	3.42	End of Cycle 1
Y	220°	3.48	End of Cycle 2
Z	40°	3.53	End of Cycle 5
V	4°	1.18	End of Cycle 8
S	140°	3.5	Retired in Place**
U*	176°	1.2	Spare
W*	184°	1.2	End of Life***
X*	356°	1.2	Spare

\*The withdrawal schedule of these capsules is interchangeable due to common materials and lead factors.

\*\*Capsule S may be withdrawn during RFO 19 if modified tooling is capable of removing the capsule is available. If not withdrawn, no capsule is required. If withdrawn, testing will be coordinated with industry to optimize the usefulness of the test data.

\*\*\*At the end of life as currently licensed, Capsule W (or U or X) will be withdrawn.

The proposed revised schedule based on a 60 year operating term is provide in Table 2 below and includes a change to the Capsule W withdrawal schedule from "End of Life" to "End of Cycle 28". This revised schedule allows capsule W to be subjected to a fluence which corresponds to the peak vessel fluence at the clad/base metal interface at the end of the 60 year operating term.

Table 2 - Proposed Revised Withdrawal Schedule

Capsule	Location	Lead Factor	Withdrawal Date
T	320°	3.42	End of Cycle 1
Y	220°	3.48	End of Cycle 2
Z	40°	3.53	End of Cycle 5
V	4°	1.18	End of Cycle 8
S	140°	3.5	Retired in Place
U*	176°	1.2	Spare
W*	184°	1.2	End of Cycle 28
X*	356°	1.2	Spare

\*The withdrawal schedule of these capsules is interchangeable due to common materials and lead factors.

The following table provides detailed fluence levels for each of the capsules.

Capsule	Capsule Location	Lead Factor	Withdrawal Outage	Withdrawal EFPY (vessel)	Capsule Fluence (n/cm <sup>2</sup> )
T	320°	3.42	RFO1	1.42	2.53 x 10 <sup>18</sup>
Y	220°	3.48	RFO2	2.34	4.55 x 10 <sup>18</sup>
Z	40°	3.53	RFO5	5.17	1.02 x 10 <sup>19</sup>
V	4°	1.18	RFO8	8.6	4.92 x 10 <sup>18</sup>
S	140°	3.5	Retired in place	N/A	N/A
U*	176°	1.2	Spare	Spare	N/A
W*	184°	1.2	RFO28	Approx. 42 EFPY	2.0 x 10 <sup>19</sup>
X*	356°	1.2	Spare	Spare	N/A

Notes:

\*The withdrawal schedule for these three capsules is interchangeable due to the common lead factor and the common materials in the capsules.

### 3.0 TECHNICAL ANALYSIS

This request proposes to revise the surveillance capsule withdrawal schedule to add the removal and testing of one additional capsule during the period of extended operation when it reaches a capsule fluence of at least one times the peak vessel, end of extended life fluence as required by ASTM E 185-82. It also administratively deletes the note to capsule S since it was not withdrawn in RFO 19. Removal and testing of one additional capsule during the

period of extended operation will provide additional reactor vessel material embrittlement information which will be incorporated into the 10CFR50.61 and Appendix G evaluations.

As listed in Table 1 above, Indian Point Unit 2 has previously removed and tested four capsules and has four additional capsules remain in the vessel. However, capsule S has been retired in place since previous attempts to remove this capsule were unsuccessful given its location in the vessel and the adjacent interferences which prevent the capsule removal tool from directly (i.e. vertically) accessing the capsule. The three remaining capsules available for removal are identical in that they contain similar material specimens and similar lead factors and therefore are interchangeable.

Based on fluence calculations provided in Reference 4, the Indian Point 2 reactor vessel is projected to reach a peak fluence at the clad/base metal interface of approximately  $1.906 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV) by the end of extended operation (i.e. 60 calendar years or 48 Effective Full Power Years, EFPY). At the current projected flux for the period of extended operation, the three remaining capsules are projected to reach the vessel peak fluence of  $1.906 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV) at approximately 40 EFPY. Since the three remaining capsules have a lead factor of approximately 1.2, a capsule fluence of  $1.906 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV) corresponds to a peak vessel fluence of approximately  $1.588 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV). Assuming that the duration of future fuel cycles remain constant at approximately 1.81 EFPY per fuel cycle, the fluence for the remaining capsules is projected to reach  $1.906 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV) at approximately refueling outage 27 (i.e. 2R27). To ensure that the next capsule has been exposed to a minimum of  $1.906 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV), the proposed schedule will require removal of the next capsule during refueling 28 (2R28) currently scheduled for March 2028 resulting in a capsule fluence of approximately  $2.0 \times 10^{19}$  n/cm<sup>2</sup> (E >1.0 MeV).

10CFR50, Appendix H requires that the surveillance capsule program "...must meet the requirements of the edition of ASTM E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased". For IP2, this is the 1966 Edition of ASTM E 185. Appendix H also requires that "...For each capsule withdrawal, the test procedures and reporting requirements must meet the requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule". Therefore, for IP2 the surveillance capsule withdrawal schedule is based on the 1966 Edition of ASTM E 185 although the IP2 schedule has been upgraded to meet the requirements of the 1982 Edition of ASTM E 185 to the extent practicable.

Since the peak  $\Delta RT_{PTS}$  increase due to fluence exceeds 200<sup>0</sup> F, ASTM E 185 requires that five capsules be withdrawn. To date, four capsules have been withdrawn (capsules T, Y, Z and V) with four capsules (i.e. capsules S, U, W and X) remaining in the vessel. Capsule W is currently scheduled to be the fifth capsule and therefore satisfy the withdrawal requirements of ASTM E 185.

#### 4.0 REFERENCES

1. 10 CFR 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."
2. 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.
3. ASTM Standard E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels".
4. WCAP-16752-NP, "Indian Point 2 Heatup and Cooldown Limit Curves for Normal Operation", Revision 0 dated January 2008.
5. Entergy letter NL-10-025, "Proposed Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule per 10 CFR 50, Appendix H", dated March 4, 2010.
6. Entergy letter NL-10-030, "Revised Proposed Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule per 10 CFR 50, Appendix H", dated March 8, 2010.
7. NRC Letter, "Indian Point Nuclear Generating Unit No. 2 – Reactor Vessel Surveillance Capsule Withdrawal Schedule Change (TAC No. ME3477)", Dated March 15, 2010.