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10 CFR 50, App H

April 11, 2018

U. S. Nuclear Regulatory Commission
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Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

Subject: Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule

Pursuant to Appendix H of 10 CFR Part 50, Calvert Cliffs Nuclear Power Plant hereby submits for approval a revision to its schedule for withdrawal of reactor vessel material surveillance capsules for Calvert Cliffs Units 1 and 2.

The proposed withdrawal schedule satisfies the requirements of American Society for Testing and Materials (ASTM) E185-70, the version that was current at the time the reactor vessels were designed. In addition, to the extent practicable, the proposed withdrawal schedules comply with ASTM E185-82. The details of the proposed revision are contained in Attachment (1) to this letter.

Should you have questions regarding this matter, please contact Mr. Larry D. Smith at (410) 495-5219.

Respectfully,

Mark D. Flaherty
Site Vice President

MDF/PSF/bjm

Attachment: (1) Proposed Revision to the Schedule for Withdrawal of Reactor Vessel Material Surveillance Capsules for Calvert Cliffs Units 1 and 2

cc: NRC Project Manager, Calvert Cliffs
NRC Regional Administrator, Region I

NRC Resident Inspector, Calvert Cliffs
S. Gray, MD-DNR

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ATTACHMENT (1)

**PROPOSED REVISION TO THE SCHEDULE FOR WITHDRAWAL OF
REACTOR VESSEL MATERIAL SURVEILLANCE CAPSULES FOR
CALVERT CLIFFS UNITS 1 AND 2**

ATTACHMENT (1)

PROPOSED REVISION TO THE SCHEDULE FOR WITHDRAWAL OF REACTOR VESSEL MATERIAL SURVEILLANCE CAPSULES FOR CALVERT CLIFFS UNITS 1 AND 2

I. BACKGROUND

Appendix H of 10 CFR Part 50 describes reactor vessel material surveillance program requirements. Paragraph (III)(B)(3) of this Appendix states that a proposed material withdrawal schedule must be submitted with a technical justification per 10 CFR 50.4, and approved prior to implementation.

The proposed withdrawal schedule satisfies the requirements of American Society for Testing and Materials (ASTM) E185-70, the version that was current at the time the reactor vessels were designed. In addition, to the extent practicable, both the proposed and the currently approved withdrawal schedules comply with ASTM E185-82.

Table (1) shows the currently approved withdrawal schedule for Calvert Cliffs Unit 1 reactor vessel surveillance capsules and Table (2) shows the currently approved withdrawal schedule for Calvert Cliffs Unit 2 reactor vessel surveillance capsules. These withdrawal schedules were approved under References 1, 2, 3, and 4.

II. PROPOSED REVISION TO THE WITHDRAWAL SCHEDULE

Tables (3) and (4) provide the proposed revision to the reactor vessel surveillance capsule withdrawal schedules for Units 1 and 2. The revised schedule is based on ASTM E185-82 recommendations, and reflects updated fluence information from the surveillance capsules removed in 2010 and 2011 with appropriate adjustment made for fuel loaded in subsequent cycles. As shown below in Section III, the proposed withdrawal schedule satisfies the requirements of ASTM E185-70, the version that was current at the time the reactor vessels were designed. Therefore, the withdrawal schedule satisfies the requirements of Appendix H to 10 CFR Part 50.

III. JUSTIFICATION

Calvert Cliffs Units 1 and 2 reactor vessels were designed to the 1965 through winter 1967 Addenda, edition of the American Society of Mechanical Engineers Code. American Society for Testing and Materials E185-70 was the current standard when the reactor vessels were designed. As stated in the Calvert Cliffs Updated Final Safety Analysis Report, the reactor vessel surveillance program meets the requirements of ASTM E185-70.

The guidance provided in ASTM E185-82 is consistent with, but more specific than, the guidance provided in earlier editions, including ASTM E185-70 to which the Calvert Cliffs Nuclear Power Plant reactor vessel surveillance program is required to conform. Therefore, compliance with the ASTM E185-82 withdrawal schedule guidance ensures compliance with ASTM E185-70 withdrawal schedule guidance. American Society for Testing and Materials E185-82 provides a withdrawal schedule in terms of years of operation but also provides the option to develop a schedule tied to target fluences accumulated in the vessel. As in the case of the currently approved withdrawal schedule, the proposed withdrawal schedule follows the guidance that ties the withdrawal schedule to vessel fluence targets. The target fluence guidance is as follows:

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Capsule No.	Fluence Target
1	When the accumulated neutron fluence of the capsule exceeds 5×10^{18} n/cm ² , or when the highest predicted delta RT _{NDT} (nil-ductility reference temperature) of all encapsulated materials is approximately 28°C (50°F), whichever comes first.
2	At a time when the accumulated neutron fluence of the capsule corresponds to a value midway between the first and the third capsules.
3	At a time when the accumulated neutron fluence on the capsule corresponds to the approximate end of life (EOL) fluence at the reactor vessel ¼ T location.
4	At a time when the accumulated neutron fluence on the capsule corresponds to the approximate EOL fluence at the reactor vessel inner wall location.
5	Not less than once or greater than twice the peak EOL vessel fluence. The capsule may be held without testing following withdrawal.

Calvert Cliffs Units 1 and 2 first three capsules have been withdrawn and analyzed. The analyses of the capsule data from the Unit 1 capsule number 3 (284°) and the Unit 2 capsule number 3 (104°) (References 5 and 6):

- provide updated neutron fluence values for Units 1 and 2 capsule number 1 (263° for both) and capsule number 2 (97° for both); the neutron fluence values for the previously withdrawn capsules were revised to reflect the current neutron fluence calculations.
- changed the target fluence values.
- changed the withdrawal date for Unit 2 capsule number 4 (83°).

These changes were made to maintain the Calvert Cliffs Reactor Vessel Surveillance Program in accordance with 10 CFR Part 50, Appendix H. Additional evaluations will be performed to adjust, if necessary, the remaining capsule withdrawal schedules as future capsules are withdrawn and analyzed. In accordance with 10 CFR Part 50, Appendix H, approval of any proposed changes will be requested before implementation.

IV. REFERENCES

1. Letter from Mr. A. W. Dromerick (NRC) to Mr. C. H. Cruse (CCNPP), dated November 8, 2000, "Safety Evaluation of Request to Revise Reactor Pressure Vessel Surveillance Program Schedule for Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2"
2. Letter from Mr. D. V. Pickett (NRC) to Mr. J. A. Spina (CCNPP), dated April 9, 2008, "Calvert Cliffs Nuclear Power Plant Unit No. 1 - Revision to Reactor Pressure Vessel Surveillance Capsule Withdrawal Schedule"
3. Letter from Mr. D. V. Pickett (NRC) to Mr. J. A. Spina (CCNPP), dated February 3, 2009, "Revision to Reactor Vessel Surveillance Capsule Withdrawal Schedule - Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2"
4. Letter from Ms. N. L. Salgado (NRC) to Mr. G. H. Gellrich (CCNPP), dated March 12, 2010, "Calvert Cliffs Nuclear Power Plant, Unit No. 1 - Reactor Vessel Surveillance Capsule Withdrawal Schedule Change"
5. E. J. Long and J. I. Duo, "Analysis of Capsule 284° from the Calvert Cliffs Unit No. 1 Reactor Vessel Radiation Surveillance Program," WCAP-17365-P Revision 0, March 2011

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6. E. J. Long and J. I. Duo, "Analysis of Capsule 104° from the Calvert Cliffs Unit No. 2 Reactor Vessel Radiation Surveillance Program," WCAP-17501-NP Revision 0, February 2012

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PROPOSED REVISION TO THE SCHEDULE FOR WITHDRAWAL OF REACTOR VESSEL MATERIAL SURVEILLANCE CAPSULES FOR CALVERT CLIFFS UNITS 1 AND 2

Table (1)

Current Unit 1 Reactor Vessel Surveillance Program
Capsule Removal Schedule

Capsule Azimuthal Position	Target Fast Neutron Fluence ($\times 10^{19}$ n/cm ²)	Projected End-of-Cycle Date
263°	0.62 ^a	Withdrawn, 1979
97°	2.64 ^b	Withdrawn, 1992
284°	3.06 ^c	2010
83°	5.26 ^d	2020
277°	6.59 ^e	2032
104°	STANDBY	

Notes:

- ^a Actual capsule fluence [Perrin, J S, et al., "Calvert Cliffs Unit No. 1 Nuclear Plant Reactor Pressure Vessel Surveillance Program: Capsule 263," Battelle Columbus Laboratories, December 1980].
- ^b Actual capsule fluence; [Lowe, A L, Jr., et al., "Analysis of Capsule 97° Baltimore Gas and Electric Company Calvert Cliffs Nuclear Power Plant Unit No. 1," B&W Nuclear Service Company, BAW-2160, June 1993].
- ^c Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel ¼ T location at end of extended life.
- ^d Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel inner wall location at end of extended life.
- ^e Withdrawal criteria - Not less than once or greater than twice the peak end of extended life vessel fluence at the vessel inner wall ($5.26 \times 10^{19} < \text{fluence in n/cm}^2 < 10.52 \times 10^{19}$). Note: This capsule also satisfies the requirement in the Nuclear Regulatory Commission safety evaluation report for Calvert Cliffs license renewal, that one capsule containing dosimetry is to be removed during the final 5 years of the extended license.

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MATERIAL SURVEILLANCE CAPSULES FOR CALVERT CLIFFS UNITS 1 AND 2

Table (2)

Current Unit 2 Reactor Vessel Surveillance Program
Capsule Removal Schedule

Capsule Azimuthal Position	Target Fast Neutron Fluence ($\times 10^{19}$ n/cm ²)	Projected End-of-Cycle Date
263°	0.806 ^a	Withdrawn, 1982
97°	1.85 ^b	Withdrawn, 1993
104°	3.24 ^c	2011
83°	6.16 ^d	2025
277°	7.46 ^e	2033
284°	STANDBY	

Notes:

- ^a Actual capsule fluence [Norris, E.B., "Reactor Vessel Material Surveillance Program for Calvert Cliffs Unit 2 Analysis of 263° Capsule," SwRI Project 06-7524, September 1985].
- ^b Actual capsule fluence [Lowe, Jr., et al., "Analysis of Capsule 97° Baltimore Gas & Electric Company Calvert Cliffs Nuclear Power Plant Unit No. 2," BAW-2199, February 1994].
- ^c Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel ¼ T location at end of extended life.
- ^d Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel inner wall location at end of extended life.
- ^e Withdrawal criteria - Not less than once or greater than twice the peak end of extended life vessel fluence at the vessel inner wall ($6.16 \times 10^{19} < \text{fluence in n/cm}^2 < 12.32 \times 10^{19}$). Note: This capsule also satisfies the requirement in the Nuclear Regulatory Commission safety evaluation report for Calvert Cliffs license renewal, that one capsule containing dosimetry is to be removed during the final 5 years of the extended license.

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PROPOSED REVISION TO THE SCHEDULE FOR WITHDRAWAL OF REACTOR VESSEL MATERIAL SURVEILLANCE CAPSULES FOR CALVERT CLIFFS UNITS 1 AND 2

Table (3)

**Proposed Unit 1 Reactor Vessel Surveillance Program
Capsule Removal Schedule**

Capsule Azimuthal Position	Target Fast Neutron Fluence (x 10¹⁹ n/cm²)	Projected End-of-Cycle Date
263°	0.505 ^a	Withdrawn, 1979
97°	1.94 ^a	Withdrawn, 1992
284°	2.33 ^a	Withdrawn, 2010
83°	4.01 ^b	2020
277°	5.09 ^c	2032
104°	STANDBY	

Notes:

- ^a Actual capsule fluence, E. J. Long and J. I. Duo, "Analysis of Capsule 284° from the Calvert Cliffs Unit No. 1 Reactor Vessel Radiation Surveillance Program," WCAP-17365-NP, Revision 0, March 2011.
- ^b Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel inner wall location at end of extended life.
- ^c Withdrawal criteria - Not less than once or greater than twice the peak end of extended life vessel fluence at the vessel inner wall ($3.86 \times 10^{19} < \text{fluence in n/cm}^2 < 7.72 \times 10^{19}$). Note: This capsule also satisfies the requirement in the Nuclear Regulatory Commission safety evaluation report for Calvert Cliffs license renewal, that one capsule containing dosimetry is to be removed during the final 5 years of the extended license.

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Table (4)

**Proposed Unit 2 Reactor Vessel Surveillance Program
Capsule Removal Schedule**

Capsule Azimuthal Position	Target Fast Neutron Fluence ($\times 10^{19}$ n/cm²)	Projected End-of-Cycle Date
263°	0.825 ^a	Withdrawn, 1982
97°	1.95 ^a	Withdrawn, 1993
104°	2.44 ^a	Withdrawn, 2011
83°	4.32 ^b	2023
277°	5.17 ^c	2033
284°	STANDBY	

Notes:

- ^a Actual capsule fluence, E. J. Long and J. I. Duo, "Analysis of Capsule 104° from the Calvert Cliffs Unit No. 2 Reactor Vessel Radiation Surveillance Program," WCAP-17501-NP Revision 0, February 2012.
- ^b Withdrawal criteria - Capsule fluence that corresponds to the projected fluence at the vessel inner wall location at end of extended life.
- ^c Withdrawal criteria - Not less than once or greater than twice the peak end of extended life vessel fluence at the vessel inner wall ($4.28 \times 10^{19} < \text{fluence in n/cm}^2 < 8.54 \times 10^{19}$). Note: This capsule also satisfies the requirement in the Nuclear Regulatory Commission safety evaluation report for Calvert Cliffs license renewal, that one capsule containing dosimetry is to be removed during the final 5 years of the extended license.