

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

November 9,2009

Mr. James A. Spina, Vice President Calvert Cliffs Nuclear Power Plant, LLC Calvert Cliffs Nuclear Power Plant 1650 Calvert Cliffs Parkway Lusby, MD 20657-4702

SUBJECT: RELIEF REQUESTS INSERVICE INSPECTION (ISI)-022 & ISI-023 TO EXTEND REACTOR VESSEL AND REACTOR VESSEL INTERNAL WELD EXAMINATIONS – CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 1 (TAC NOS. ME0668 AND ME0669)

Dear Mr. Spina:

By letter dated February 18, 2009, Calvert Cliffs Nuclear Power Plant, Inc. (subsequently renamed Calvert Cliffs Nuclear Power Plant, LLC, the licensee), requested Nuclear Regulatory Commission (NRC) approval for Calvert Cliffs Nuclear Power Plant, Unit No. 1 to implement two related alternatives to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Paragraph IWB-2412, Inspection Program B. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), Relief Request ISI-022 would extend the ISI interval for examinations of the reactor pressure vessel welds (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years, up to the end of the license. Pursuant to 10 CFR Section 50.55a(a)(3)(ii), Relief Request ISI-023 would place the visual inspections of Category B-N-2 and B-N-3 Welded Core Support Structures and Interior Attachment Welds on the same 20-year interval as the Category B-A and B-D components.

The NRC staff has completed its review of the information provided by the licensee for ISI-022 and ISI-023. The staff concludes that the information provided by the licensee supports the granting of alternative ISI-022 pursuant to 10 CFR 50.55a(a)(3)(i) because the alternative provides an acceptable level of quality and safety. For ISI-023, the staff concludes that the inspections required by Section XI of the ASME Code would result in hardship without a compensating increase in the level of quality and safety and the alternative can be granted according to the provisions of 10 CFR 50.55a(a)(3)(i). As discussed in the enclosed safety evaluation, both alternatives are approved for the current ISI interval, now extended to 2018.

J. Spina

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Please contact Douglas Pickett at 301-415-1364 if you have any questions.

Sincerely,

Nancy L. Salgado Nancy L. Salgado, Chief

Nancy L. Salgado, Chief Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-317

Enclosure: Safety Evaluation

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REACTOR VESSEL INSERVICE INSPECTION INTERVAL EXTENSION

RELIEF REQUEST NOS. ISI-022 AND ISI-023

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 1

1.0 INTRODUCTION

By letter dated February 18, 2009¹, Calvert Cliffs Nuclear Power Plant, Inc. (subsequently renamed Calvert Cliffs Nuclear Power Plant, LLC, the licensee), requested Nuclear Regulatory Commission (NRC) approval for Calvert Cliffs Nuclear Power Plant, Unit No. 1 to implement two related alternatives to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Paragraph IWB-2412, Inspection Program B. Specifically, the first alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i); the second under 10 CFR Section 50.55a(a)(3)(ii). The licensee requested approval for the use of the first alternative, ISI-022, to extend the inservice inspection (ISI) interval for examinations of the reactor pressure vessel (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years, up to the end of the license (EOL). The second proposed alternative, ISI-023, would place the visual inspections of Category B-N-2 and B-N-3 Welded Core Support Structures and Interior Attachment Welds on the same interval as the Category B-A and B-D components.

2.0 REGULATORY REQUIREMENTS

In accordance with 10 CFR 50.55a(g)(4), the licensee is required to perform ISI of ASME Code Class 1, 2, and 3 components and system pressure tests during the first 10-year interval and subsequent 10-year intervals that comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed therein.

For the current (third) ISI interval at Calvert Cliffs, Unit 1, which will end on June 30, 2010, the code of record for the inspection of ASME Code Class 1, 2, and 3 components is the 1998 Edition (with no addenda) of the ASME Code, Section XI. The regulation in 10 CFR 50.55a(a)(3) states, in part, that the Director of the Office of Nuclear Reactor Regulation (NRR) may authorize an alternative to the requirements of 10 CFR 50.55a(g). For an alternative to be authorized, as per 10 CFR 50.55a(a)(3)(i), the licensee must demonstrate that the proposed alternative would provide an acceptable level of quality and safety; or per 10 CFR 50.55a(a)(3)(ii), the licensee must show that following the ASME Code requirements would

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¹ ADAMS Accession No. ML090540062

result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.1 Background

The ISI of Category B-A and B-D components consists of visual and ultrasonic examinations intended to discover whether flaws have initiated, whether pre-existing flaws have extended, and whether pre-existing flaws may have been missed in prior examinations. The visual inspection of Category B-N-2 and B-N-3 components has always been done at the same time as the ISI of Category B-A and B-D components. These examinations are required to be performed at regular intervals, as defined in Section XI of the ASME Code. Performing all of these inspections at the same time reduces the number of times that the unit's full core and internals must be moved to gain access for the examinations.

2.2 Summary of WCAP-16168-NP, Revision 2

In 2006, the Pressurized Water Reactor (PWR) Owners Group submitted Topical Report WCAP-16168-NP, Revision 2² (referred to as the WCAP in the rest of the document), to the NRC in support of making a risk-informed assessment of extensions to the ISI intervals for Category B-A and B-D components. In the report, the PWR Owners Group took data associated with three different PWR plants (referred to as the pilot plants), one designed by each of the main contractors for nuclear power plants in the USA, and performed the necessary studies on each of the pilot plants required to justify the proposed extension for the ISI interval for Category B-A and B-D components from 10 to 20 years.

The analyses in the WCAP used probabilistic fracture mechanics tools and inputs from the work described in the NRC's pressurized thermal shock (PTS) risk re-evaluation^{3,4}. The PWR Owners Group analyses incorporated the effects of fatigue crack growth and inservice inspection. Design basis transient data was used as input to the fatigue crack growth evaluation. The effects of ISI were modeled consistently with the previously-approved probabilistic fracture mechanics codes⁵. These effects were put into evaluations performed with the Fracture Analysis of Vessels-Oak Ridge (FAVOR) code⁶. All other inputs were identical to those used in the PTS risk re-evaluation.

From the results of the studies, the PWR Owners Group concluded that the ASME Code, Section XI 10-year inspection interval for Category B-A and B-D components in PWR reactor vessels can be extended to 20 years. Their conclusion from the results for the pilot plants was considered to apply to any plant designed by the three vendors (Westinghouse, Combustion Engineering, and Babcock and Wilcox) as long as the critical, plant-specific parameters (defined in Appendix A of the WCAP) are bounded by the pilot plants.

² WCAP-16168-NP, Rev. 2, ADAMS Accession No. ML060330504

³ NUREG-1806, ADAMS Accession No. ML061580318

⁴ NUREG-1874, ADAMS Accession No. ML070860156

⁵ WCAP-14572-NP-A, ADAMS Accession Nos. ML012630327, ML012630349, and ML12630313

⁶ ONRL/NRC/LTR0418, ADAMS Accession No. ML042960391

2.3 Summary of NRC Safety Evaluation (SE)

The NRC staff's conclusion in its SE⁷ indicates that the methodology presented in the WCAP, in concert with the guidance provide by Regulatory Guide (RG) 1.174, Rev. 1⁸, is acceptable for referencing in requests to implement alternatives to ASME Code inspection requirements for PWR plants in accordance with the limitations and conditions in the SE. In addition to showing that the subject plant is bounded by the pilot plants' information from Appendix A in the WCAP, the key points of the SE are summarized below:

- The dates identified in the request for alternative should be within plus or minus one refueling cycle of the dates identified in the implementation plan provided to the NRC. Any deviations from the implementation plan⁹ should be discussed in detail in the request for alternative. The maximum proposed ISI interval is 20 years.
- 2. The requirements for reporting the results of ISIs found in the voluntary PTS rule apply in all cases. Licensees that do not implement the voluntary PTS rule must amend their licenses to require that the information and analyses requested in the voluntary PTS rule be submitted for NRC staff review and approval. The amendment to the license shall be submitted at the same time as the request for alternative ISI interval.
- 3. The request for alternative ISI interval can use any NRC-approved method to calculate ΔT_{30} and RT_{MAX-X}^{10} However, if the request uses the NUREG-1874 methodology to calculate ΔT_{30} , then the request should include the analysis described in paragraph (6) of subsection (f) to the voluntary PTS rule. The analysis should be done for all of the materials in the beltline area with at least three surveillance data points.
- 4. If the subject plant is a Babcock & Wilcox designed plant:
 - Licensees must verify that the fatigue crack growth of 12 heat-up/cool-down transients per year bound the fatigue crack growth for all of its design basis transients,
 - Licensees must identify the design basis transients that contribute to significant fatigue crack growth.
- 5. If the subject plant has RPV forgings that are susceptible to underclad cracking or if the RPV includes forgings with RT_{MAX-FO}¹⁰ values exceeding 240 °F, then the WCAP analyses are not applicable. The licensee must submit a plant-specific evaluation for any extension to the 10-year inspection interval for ASME Code, Section XI, Category B-A and B-D RV welds.

⁷ US NRC SE for Footnote 2, ADAMS Accession No. ML0929200462

⁸ Reg. Guide 1.174, Rev. 1, ADAMS Accession No. ML023240437

⁹ PWR Owners Group Letter OG-06-356, ADAMS Accession No. ML082210245

¹⁰ Defined in NUREG-1874, ADAMS Accession #ML070860156.

3.0 ALTERNATIVES PROPOSED FOR CALVERT CLIFFS, UNIT NO. 1

3.1 Description of Proposed Alternatives

In ISI-022, the licensee proposes to defer the ASME Code required Category B-A and B-D weld ISI of Calvert Cliffs, Unit 1 until 2018 (a 20-year interval from the last inspection). This schedule is consistent with the information in PWR Owers Group letter, OG-06-356.

For ISI-023, the licensee proposes the interval for Category B-N-2 and B-N-3 inspections be the same as that for Category B-A and B-D inspections.

3.2 Components for Which Relief is Requested

The affected components are the subject plant RPV and its interior attachments and core support structure. The following examination categories and item numbers from IWB-2500 and Table IWB-2500-1 of the ASME Code, Section XI, are addressed in this request:

For Relief Request ISI-022:

Examination Category	Item Number	Description	
B-A	B1.11	Circumferential Shell Weld	
B-A	B1.12	Longitudinal Shell Welds	
B-A	B1.21	Circumferential Head Weld	
B-A	B1.22	Meridional Head Weld	
B-A	B1.30	Shell-to-Flange Weld	
B-D	B3.90	Nozzle-to-Vessel Welds	
B-D	B3.100	Nozzle Inner Radius Areas	

For Relief Request ISI-023:

Examination Category	Item Number	Description
B-N-2	B13.50	Interior Attachments Within Beltline Region
B-N-2	B13.60	Interior Attachments Beyond Beltline Region
B-N-3	B13.70	Core Support Structure

3.3 Basis for Proposed Alternatives

3.3.1 Basis for ISI-022

The basis for the first alternative is found in the NRC-approved version of the WCAP¹¹ (referred to as WCAP-A). Plant-specific parameters for the subject plant are summarized in Attachment (1) to the licensee's letter of February 18, 2009. The format of the information is patterned after that found in Appendix A of the WCAP.

¹¹ WCAP-16168-NP-A, Rev. 2, ADAMS Accession No. ML0828200462

All of the critical parameters listed in Tables 1, 2, and 3 of Attachment (1) to the licensee's letter of February 18, 2009, are bounded by the WCAP-A pilot plant.

3.3.2 Basis for ISI-023

The basis for the second alternative is that performing the visual inspections of the B-N-2 and B-N-3 components on a different schedule than the Category B-A and B-D components would result in significant hardship without a compensating increase in safety. The licensee points out that the Category B-N-2 and B-N-3 components have been inspected regularly in the past and no significant indications were noted. Likewise, a review of the same Category B-N-2 and B-N-3 inspections at other, similar nuclear power plants have been performed many times without finding a significant indication.

Furthermore, the licensee notes that Category B-N-1 visual inspections and B-P pressure tests are always done during each refueling outage and are not affected by this alternative.

3.4 Duration of Proposed Alternatives

The licensee requests that the two proposed alternatives (ISI-022 and ISI-023) should be applicable for the remainder of the 60-year operating license at Calvert Cliffs, Unit 1.

4.0 <u>STAFF TECHNICAL EVALUATION</u>

4.1 ISI-022

The NRC staff has reviewed Attachment (1) to the licensee's letter dated February 18, 2009, to make this evaluation. The "Frequency and Severity of Design Transients" of Calvert Cliffs, Unit No. 1 were found to be bounded by the WCAP-A. Also, the Calvert Cliffs, Unit No. 1 RPV is single-layer clad and is bounded by the WCAP-A.

Table 2 of the submittal includes additional information pertaining to previous RPV inspections and the schedule for future ones. The proposed third ISI interval inspection for Calvert Cliffs, Unit No. 1 would be in 2018, consistent with the PWR Owners Group letter OG-06-356. There were a total of 15 indications detected in the most recent ISI, but only one was found in the beltline region of the RPV. The one indication found in the beltline region was not within 1 inch of the inside of the vessel. All of the indications were acceptable per IWB-3500 of the ASME Code, Section XI and the requirements of the proposed alternate PTS Rule (10 CFR 50.61a), so therefore, there is no requirement for remedial action or further analysis.

The calculation of TWCF_{95-TOTAL}¹⁰ was performed using Table 3 of the submittal as a basis. The request uses the NUREG-1874 methodology to calculate ΔT_{30} . The only beltline materials from the subject plant with at least three surveillance results were the weld metal 33A277 (Weld 9-203) and the axial welds, heat #12008/20291 (welds 2-203 A, B, C). The analysis, taken from the proposed 10 CFR 50.61a rule, paragraphs (f)(6)(i) through (f)(6)(iv), demonstrated that the surveillance results for the two welds pass all three tests for mean deviation, slope deviation, and outlier deviation. Therefore, the licensee's use of NUREG-1874 methodology to calculate ΔT_{30} is a valid prediction of the neutron embrittlement trend in the baseline materials. The

calculations were independently verified via NRC staff calculation and the difference between the licensee's and staff's calculations were found to be insignificant. In addition, the staff calculated ΔT_{30} values according to RG 1.99, Rev. 2¹² to compare to the methodology used in NUREG-1874; the NUREG-1874 values were similar to those calculated according to RG 1.99, Rev. 2. The TWCF_{95-TOTAL} was found to be acceptably low as calculated through the methodology prescribed in the WCAP-A and detailed in Table 3 of the submittal.

At the time of issuance of the WCAP-A, it was the NRC's intent to establish a process by which licensees could receive approval to implement 20-year ISI intervals for the subject component examinations through the end of their facility's current operating license. This objective led to the provision established in the WCAP-A that the licensee would submit a license condition which required the licensee to evaluate future volumetric ISI data in accordance with the criteria in the draft and/or final alternative PTS Rule, 10 CFR 50.61a. However, since that time, further guidance from the NRC's Office of General Counsel has resulted in a modification of this NRC position.

Based on the current guidance, the NRC staff will grant ISI interval extensions for the subject components on an interval-by-interval basis, i.e., only a facility's current ISI interval will be extended for up to 20 years. Licensees will have to submit updated alternatives to the NRC for review and approval to extend each following ISI interval from 10 years to 20 years, as needed. Based on this new NRC position, the requirement in WCAP-A for a license condition to address the evaluation of future ISI data (see Section 2.3, item 2) is no longer necessary in conjunction with this requested alternative. However, in order to obtain NRC staff approval, a subsequent updated alternative that seeks to extend an ISI interval from 10 to 20 years for the subject component examinations should include the evaluation of a facility's most recent ISI data in accordance with the criteria in the final alternative PTS Rule, 10 CFR 50.61a. For purposes of technical and regulatory consistency, the NRC SE will be revised to reflect these changes in NRC position regarding the implementation of ISI interval extensions based on WCAP-A. Therefore, the staff will only approve ISI-022 for the third ISI interval that will now end on June 30, 2018.

In summary, the licensee has demonstrated through the submittal that the RPV for Calvert Cliffs, Unit No. 1 is bounded by the WCAP-A. The submittal demonstrates that there is no significant additional risk associated with extending the ISI interval for Category B-A and B-D components from 10 years to 20 years.

4.2 ISI-023

The NRC staff has considered ISI-023 and agrees that the subject inspections can only be done after the fuel and internals are removed from the RPV, which is usually only done at the same time as the ISI of Category B-A and B-D components. None of the previous inspections of Category B-N-2 and B-N-3 components at Calvert Cliffs, Unit No. 1 identified any significant indications of cracking or any other problems. No evidence of service-induced degradation has been noted in the same inspections at other similar nuclear power plants. The staff notes that no other nuclear power plant performs the Category B-N-2 and B-N-3 ISI on a different interval

¹² NRC Regulatory Guide 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials", May, 1988.

schedule than that for the ISI for Category B-A and B-D welds. Furthermore, the staff agrees that the change in interval for the inspections does not impact the defense-in-depth philosophy. Hence, the alternative proposed is acceptable under the provisions of 10 CFR 50.55a(a)(3)(ii) until the end of the third interval, which will now be June 30, 2018.

5.0 CONCLUSION

The NRC staff has completed its review of the submittals for ISI-022 and ISI-023 regarding Calvert Cliffs, Unit No. 1. For Relief Request ISI-022, the staff concludes that increasing the ISI interval for Category B-A and B-D components from 10 years to 20 years shows no appreciable increase in risk. The staff comes to this conclusion based on the fact that the plant-specific information provided by the licensee is bounded by the data in the WCAP-A and the request meets all the conditions and limitations described in the WCAP-A. Therefore, Relief Request ISI-022 provides an acceptable level of quality and safety and the alternative can be granted pursuant to 10 CFR 50.55a(a)(3)(i) until the end of the third interval for Categories B-A and B-D components at Calvert Cliffs, Unit No. 1 on June 30, 2018.

For Relief Request ISI-023, the staff concludes that performing the ISI of Category B-N-2 and B-N-3 components every 10 years as required by Section XI of the ASME Code would result in hardship without a compensating increase in the level of quality and safety given the approval of ISI-022. The staff agrees that the Category B-N-2 and B-N-3 inspections should be performed every 20 years, as proposed and the alternative can be granted according to the provisions of 10 CFR 50.55a(a)(3)(ii) until the end of the third interval for Categories B-N-2 and B-N-3 components at Calvert Cliffs, Unit No. 1 on June 30, 2018.

All other requirements of the ASME Code, Section XI, not specifically included in the request for the proposed alternatives, remain in effect.

Principal Contributor: Patrick Purtscher

Date: November 9, 2009

J. Spina

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Please contact Douglas Pickett at 301-415-1364 if you have any questions.

Sincerely,

/RA/

Nancy L. Salgado, Chief Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-317

Enclosure: Safety Evaluation

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