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10 CFR 50.55a

November 16, 2021

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

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

Subject: Response to Request for Additional Information - Proposed Alternative for Examination of Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds

References:
1) Letter from D. Gudger (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Proposed Alternative for Examination of Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds," dated May 12, 2021 (ML21133A297)

2) Email from A. Mayer (U.S. Nuclear Regulatory Commission) to T. Loomis (Exelon Generation Company, LLC), "Calvert Cliffs Nuclear Power Plant, Units 1 and 2 - Request for Additional Information re: Proposed Alternative for Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds (EPID L-2021-LLR-0037)," dated October 13, 2021 (ML21287A032)

In the Reference 1 letter, in accordance with 10 CFR 50.55a(z)(1), Exelon Generation Company, LLC (Exelon) requested NRC approval of a proposed alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," on the basis that the proposed alternative provides an acceptable level of quality and safety. Specifically, Exelon requested an alternative to volumetric examination of pressurizer circumferential and longitudinal shell-to-head welds and nozzle-to-shell welds to extend the inspection frequency from 10 years to the remainder of the currently licensed operating periods for Braidwood Generating Station (Braidwood), Units 1 and 2,

Byron Generating Station (Byron), Units 1 and 2, and Calvert Cliffs Nuclear Power Plant (Calvert Cliffs), Units 1 and 2.

In Reference 2, the U.S. Nuclear Regulatory Commission requested additional information involving Calvert Cliffs Nuclear Power Plant, Units 1 and 2. Attached is our response.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this matter, please contact Tom Loomis at (610) 765-5510.

Respectfully,

David P. Helker
Senior Manager - Licensing
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information

cc: Regional Administrator - NRC Region I
Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Senior Resident Inspector - Byron Station
NRC Senior Resident Inspector - Calvert Cliffs Nuclear Power Plant
NRC Project Manager - Braidwood Station
NRC Project Manager - Byron Station
NRC Project Manager - Calvert Cliffs Nuclear Power Plant
Illinois Emergency Management Agency – Division of Nuclear Safety
S. Seaman, State of Maryland

Attachment 1

Response to Request for Additional Information

By letter dated May 12, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21133A297), Exelon Generation Company, LLC (Exelon, the licensee) requested U.S. Nuclear Regulatory Commission (NRC) approval of an alternative, RS 21-056, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55 a(z)(1)(i) to the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) at Calvert Cliffs Nuclear Plant Units 1 and 2 (Calvert Cliffs 1 and 2). The proposed alternatives for Braidwood Station Units 1 and 2 and Bryon Station Units 1 and 2 included in the letter are being reviewed separately. The proposed alternative would allow the licensee to forego ASME Code, Section XI-required examinations of various pressurizer welds through the end of the extended licenses.

The NRC staff has determined that additional information is needed to complete its review of the request. The draft request for additional information (RAI) was sent to Exelon on October 1, 2021, and a clarification call was held with Exelon staff on October 13, 2021. It was agreed that Exelon would provide a response no later than November 19, 2021.

REQUEST FOR ADDITIONAL INFORMATION

Pursuant to 10 CFR 50, Paragraph 50.55a(z)(1), the licensee proposed to increase the inservice inspection (ISI) interval for the subject components to the end of the current approved period of extended operation, from the current ASME Code Section, Section XI requirement of 10 years. Paragraph 50.55a(z)(1) of 10 CFR requires the licensee to demonstrate that the proposed alternative provides an acceptable level of quality and safety. The licensee referred to the analyses in nonproprietary Electric Power Research Institute (EPRI) Report No. 3002015905, "Technical Bases for Inspection Requirements for PWR Pressurizer Head, Shell-to-Head, and Nozzle-to-Vessel Welds", December 2019 (ADAMS Accession No. ML21021A271) to support the proposed alternative in the submittal. The licensee also included an applicability evaluation of EPRI Report 3002015905 to Calvert Cliffs 1 and 2 in the submittal.

RAI 1

In Appendix D of the licensee's submittal, the licensee stated that Calvert Cliffs 1 and 2 does not track thermal transients. The licensee instead provided fatigue usage factors and environmental-assisted fatigue usage factors. The licensee stated that Calvert Cliffs 1 and 2 meet the design limits for fatigue usage factor up to 60 years of operation. The staff notes that compliance with design requirements does not imply that the probabilistic fracture mechanics (PFM) evaluation in EPRI Report 3002015905 is an appropriate basis for inspection relief for the Calvert Cliffs 1 and 2 pressurizer welds. While the application provides some insight relative to the EPRI report modeling, the staff is unable to compare these results with the population of cycles modeled in the EPRI report. This is particularly important in that several of the subject components also received low inspection coverage values, creating combined uncertainties relative to the applicability of the EPRI model. An appropriate technical basis should include a discussion for why the analyzed fatigue histories are a reasonable representation of the actual fatigue histories.

Provide a technical basis related to fatigue history, irrespective of compliance with design requirements, for why the generic PFM in EPRI Report 3002015905 is an appropriate basis for inspection relief at Calvert Cliffs 1 and 2.

RESPONSE

In lieu of providing a technical basis related to fatigue history used in the proposed alternative, Exelon has elected to review the insurge/outsurge transients for Calvert Cliffs and provide a comparison to the EPRI Report [RAI1-2]. The conservative design insurge/outsurge transients defined in Table 3-9 of Reference [RAI1-1] for Calvert Cliffs were used to compare with those stipulated in Section 9 of the EPRI report [RAI1-2]. The insurge/outsurge transients from Reference [RAI1-1] were derived for 500 heatups/cooldowns and are shown in Table RAI1-1 below.

Table RAI1-1
Insurge/Outsurge Transients for Calvert Cliffs Units 1 and 2 [RAI1-1]

Transient Number	System ΔT (°F)	Starting Temp (°F)	Flow Rate (gpm)	Cycles		
				Zone 1	Zone 2	Total
14	320	653	200	0	60	60
15	320	400	100	0	70	70
16	300	653	100	70	60	130
17	300	400	100	70	460	530
18	275	400	200	0	120	120
19	275	400	100	170	840	1010
20	250	653	100	200	120	320
21	250	400	200	0	60	60
22	250	400	100	260	950	1210
23	200	653	650	0	170	170
24	200	653	100	1370	540	1910
25	200	400	100	120	230	350
26	100	653	200	2970	390	3360
27	100	400	650	240	580	820

From Appendix C, Table C-5 of the Request for Alternative, the 60-year projected heatup and cooldown cycles for Calvert Cliffs Unit 1 are 152 and 149, respectively, and for Unit 2 these cycles are 120 and 117, respectively. Hence the total number of cycles in Table RAI1-1 are factored by 152/500 for Unit 1 and 120/500 for Unit 2. For comparison with the EPRI report, the transients are grouped as follows:

1. 103 °F < $\Delta T \leq$ 330 °F
2. $\Delta T \leq$ 103 °F

The comparison with the EPRI report is shown in Table RAI1-2. As this table shows, using the conservatively derived insurge/outsurge transients and projecting them to the 60-year number of heatup/cooldown cycles, the insurge/outsurge transients at Calvert Cliffs Units 1 and 2 are below those allowed by the EPRI report.

Table RAI1-2
Comparison of Calvert Cliffs Units 1 and 2 Insurge/Outsurge Projected 60-Year Cycles to Cycles from Reference [RAI1-2]

ΔT (°F)	60-Year No. of Cycles from Table 5-9 of [RAI1-2]	Calvert Cliffs Unit 1 Cycles Projected to 60 Years of Operation	Calvert Cliffs Unit 2 Cycles Projected to 60 Years of Operation
103 °F < ΔT ≤ 330 °F	3600	1806	1426
ΔT ≤ 103 °F	1500	1271	1003

REFERENCES FOR RAI 1

RAI1-1. Dominion Engineering, Inc. Document No. R-3676-00-03, Rev. 0, "Evaluation of Thermal Stratification and MUR Uprate Effects on the Calvert Cliffs Nuclear Power Plant Units 1 & 2 Pressurizer Bottom Head," April 2007.

RAI1-2. *Technical Bases for Inspection Requirements for PWR Pressurizer Vessel Head, Shell-to-Head, and Nozzle-to-Vessel Welds*. EPRI, Palo Alto, CA: 2019. 3002015905, ADAMS Accession No. ML21021A271.

RAI 2

The requested alternative relies on the applicability of the conclusions of EPRI Report 3002015905 to the subject components to justify the requested alternative. The staff notes that the report demonstrates that successful preservice inspection (PSI) and ISI impact calculated outcomes for the subject components, particularly significant for the limiting component in the analysis (i.e. approaching the risk criterion used in the report).

The staff noted that for both Calvert Cliffs units the results of the PSI were not reported, and for a significant number of the components, low inspection volumes were achieved. In addition, the staff understands that the PROMISE model is unable to model situations where a specific volume of a component cannot be inspected in successive inspections (i.e. the program generates a new "miss" chance for each inspection round, modeling a random chance that any modeled flaw may be identified by a modeled inspection round). The lack of verifiable PSI results coupled with low inspectability of a large volume of material is not well addressed by the sensitivity studies reported in the EPRI report.

Provide a technical basis related to how the subject pressurizer welds at the Calvert Cliffs units, in particular the pressurizer welds with less than 50 percent coverage, can be considered adequately represented by the modeling in the EPRI Report; or otherwise justified.

RESPONSE

As used in the EPRI Report [RAI2-3], preservice examination (PSI) refers to the collective examinations required by ASME Section III during fabrication and any ASME Section XI examinations performed prior to service. The Section III fabrication examinations required for these components were robust and any ASME XI preservice examinations further contributed to thorough initial examinations.

Calvert Cliffs Units 1 and 2 were designed and fabricated in accordance with ASME Section III 1965 Edition with Winter 1967 Addenda. Manufacturers Data Reports for Nuclear Vessels (Form NIS-1/-1A) were completed for both Calvert Cliffs Unit 1 and 2 certifying that the pressurizers were designed and fabricated (including all necessary shop inspections) in accordance with ASME Section III. ASME XI preservice examinations were performed for Calvert Cliffs Unit 1 and 2 prior to initial service and the results are provided in Table 4 of the Request for Alternative. There were no recordable indications identified for any of the subject welds during ASME XI preservice examinations. Examination coverage was not specifically reported for these examinations as it was not common practice at the time. However, given the completion of the ASME III fabrication examinations and ASME XI preservice examinations it is concluded that Calvert Cliffs Units 1 and 2 meet the requirements of the EPRI Report [RAI2-3] for 100% preservice examination coverage.

A sensitivity analysis was performed using the specific coverages obtained during the Calvert Cliffs Units 1 and 2 inspections. The coverages are presented in Table 4 of the Request for Alternative and are summarized in Table RAI2-1. In this table, when the coverage was not available for a particular interval, the minimum coverage for the remaining intervals is assumed for that interval. From a review of the Table RAI2-1 coverages, four components (identified in **bold** below) were judged to be limiting and were therefore selected for the sensitivity analyses.

Table RAI2-1
Summary of Examination Coverage for Calvert Cliffs Units 1 and 2

Unit	Component	Item No.	Stress Path ID from Ref	Coverage (%)					
				PSI	1st Interval	2nd Interval	3rd Interval	4th Interval	5th Interval
1	**4-404 Surge Noz to Shell**	**B3.110**	**PRNV-BW-1**	**100**	**31.8**	**71.0**	**65.9**	**31.8**	**NYP**
1	4-405 Spray Noz to Shell	B3.110	PRNV-CE-4	100	66.4	66.4	66.4	66.4	NYP
1	**16-405A SR Noz to Shell**	**B3.110**	**PRNV-CE-4**	**100**	**36.0**	**36.0**	**36.0**	**60.5**	**NYP**
1	16-405B SR Noz to Shell	B3.110	PRNV-CE-4	100	36.0	79.7	36.0	60.5	NYP
2	**4-404 Surge Noz to Shell**	**B3.110**	**PRNV-BW-1**	**100**	**28.2**	**63.0**	**69.5**	**56.0**	**28.2**
2	4-405 Spray Noz to Shell	B3.110	PRNV-CE-4	100	53.0	53.0	53.0	65.0	62.1
2	**16-405A SR Noz to Shell**	**B3.110**	**PRNV-CE-4**	**100**	**41.0**	**98.0**	**41.0**	**58.0**	**55.3**
2	16-405B SR Noz to Shell	B3.110	PRNV-CE-4	100	41.9	41.9	41.9	60.5	55.3

The sensitivity analyses were performed similarly to those performed in Reference [RAI2-1] to address the limited coverage of 37.2% at Salem Units 1 and 2 and found acceptable by the NRC in Section 10 of Reference [RAI2-2]. Since Component 4-404 (for both Unit 1 and Unit 2) is a surge nozzle-to-shell weld, Stress Path 1 (see Figure 7-9 of the EPRI report [RAI2-3]) and corresponding Case IDs PRNV-BW-1A and PRNV-BW-1C (see Table 8-4 of EPRI report [RAI2-3]) were considered for these components. Similarly, since component 16-405A (for both Unit 1 and Unit 2) is a safety/relief nozzle-to-shell weld, Stress Paths 4, 5 and 6 from Figure 7-21 of the EPRI report apply. The most limiting of these Stress Paths is Stress Path 4 with Case IDs PRNV-CE-4A and PRNV-CE-4C (see Table 8-4 of the EPRI report). These Case IDs were therefore considered for evaluation of these components.

The evaluations were performed using Version 2.0 of the **PROMISE** software code [RAI2-4], the same version used for the evaluations in the EPRI report [RAI2-3]. The description provided in the RAI of how **PROMISE** treats coverage is incorrect. A correct description of how **PROMISE** treats coverage, and the NRC acceptance of that approach, can be found in Section 8.0 (page 14) of Reference [RAI2-2].

Evaluations were performed using the limiting coverages shown in Table RAI2-1 to determine the probabilities of rupture and leakage for the plant-specific inspection scenarios of (PSI+10+20+30+40+70) for Unit 1 and (PSI+10+20+30+40+50+70) for Unit 2. For comparison, evaluations were also performed for the current ASME Code, Section XI mandated inspection interval of (PSI+10+20+30+40+50+60+70). The evaluations were performed with a combination of the most dominant parameters (stress and fracture toughness) as identified by the NRC in Section 4.0 (page 6) and Section 10 (page 19) of Reference [RAI2-2]. Since all welds under consideration are shell welds, a flaw density of 1.0 was used in the evaluation. This flaw density value was found acceptable by the NRC in Section 9.6 of Reference [RAI2-2]. A fracture toughness of 200 ksi√in with a standard deviation of 5 ksi√in was used, as recommended by the NRC in Section 10 (page 19) of Reference [RAI2-2]. A stress multiplier of 1.2 was used in these evaluations. This stress multiplier was conservatively chosen such that probability of rupture or leakage will be close to the acceptance criteria of 1.0E-06 after 80 years.

The results of the evaluations are presented in Table RAI2-2.

Table RAI2-2
Sensitivity Study for ISI Examination Coverage for Calvert Cliffs Units 1 and 2
Surge and Safety/Relief Nozzle-to-Shell Welds

Unit	Component	Stress Path ID	ASME Section XI Inspection Interval 0,10,20,30,40,50,60,70 Flaw density = 1.0 K = 200 ksi√in, SD = 5 ksi√in Stress multiplier = 1.2		Alternate Inspection Interval 0,10,20,30,40,70 (Unit 1) 0,10,20,30,40,50,70 (Unit 2) Flaw density = 1.0 K = 200 ksi√in, SD = 5 ksi√in Stress multiplier = 1.2	
			Probability of Rupture	Probability of Leakage	Probability of Rupture	Probability of Leakage
1	4-404	PRNV-BW-1A	1.25E-09	1.25E-09	1.25E-09	1.25E-09
1	4-404	PRNV-BW-1C	1.25E-09	3.48E-07	1.25E-09	3.54E-07
1	16-405A	PRNV-CE-4A	1.25E-09	1.25E-09	1.25E-09	1.25E-09
1	16-405A	PRNV-CE-4C	1.25E-09	1.25E-09	1.25E-09	1.25E-09
2	4-404	PRNV-BW-1A	1.25E-09	1.25E-09	1.25E-09	1.25E-09
2	4-404	PRNV-BW-1C	1.25E-09	3.14E-07	1.25E-09	3.26E-07
2	16-405A	PRNV-CE-4A	1.25E-09	1.25E-09	1.25E-09	1.25E-09
2	16-405A	PRNV-CE-4C	1.25E-09	1.25E-09	1.25E-09	1.25E-09

As shown in Table RAI2-2, considering the limited coverage and the inspection schedule in the Request for Alternative, the probabilities of rupture and leakage are below the acceptance criteria of 1.0E-06 after 80 years of operation. Furthermore, when the probabilities of rupture and leakage for the inspection schedule in the Request for Alternative are compared to the present ASME Code, Section XI inspection schedule, there is a negligible difference. This indicates that the change in risk from the current ASME Code, Section XI schedule to that in the Request for Alternative is insignificant.

As noted in Section 5.1 (page 7) of Reference [RAI2-2], the most dominant stress is the pressure stress, and therefore the R_i/t ratio is a good measure of the difference in stress between the component geometry at Calvert Cliffs and that used in the EPRI report [RAI2-3]. Table RAI2-3 provides a comparison of the model dimensions used in the EPRI report and the dimensions of the pressurizer at Calvert Cliffs. This table shows that the R_i/t ratios (where R_i is the inside radius) used for the model in the EPRI report are much higher than those at Calvert Cliffs. The implication is that the stresses determined from the model in the EPRI report are very conservative in application to Calvert Cliffs. In determining the probabilities of rupture and leakage in Table RAI2-2, a stress multiplier of 1.2 was used (20% greater than was used in the EPRI report). This demonstrates that there is significant margin and therefore no increase in risk associated with the reduced coverage at Calvert Cliffs Units 1 and 2.

Table RAI2-3
Comparison of Model Geometry in [RAI2-3] and Calvert Cliffs Units 1 and 2

Component	Parameter	Modeled in EPRI Report	Calvert Cliffs Units 1 and 2	Ratio of Calvert Cliffs Units 1 and 2 R/t to Model
Pressurizer Main Shell	Inside Radius R_i (in)	42.0	48.125	-
	Thickness. (t) (in)	3.75	4.875	-
	(R_i/t)	11.2	9.84	0.88
Pressurizer Bottom Head	Inside Radius R_i (in)	43	48.4375	-
	Thickness. (t) (in)	2.55	3.875	-
	(R_i/t)	16.86	12.5	0.74
Surge Line Nozzle	Inside Radius R_i (in)	6.22	5.9375	-
	Thickness. (t) (in)	1.28	4.3125	-
	(R_i/t)	4.85	1.376	0.28
Safety/Relief Nozzle	Inside Radius R_i (in)	2.815	1.719	-
	Thickness. (t) (in)	1.1875	1.3125	-
	(R_i/t)	2.37	1.31	0.55

REFERENCES FOR RAI 2

RAI2-1. Letter from P. Duke, Jr. (PSEG Nuclear LLC) to U.S.NRC, “Proposed Alternative for Examination of ASME Section XI, Examination Category B-B, Item Number B2.11 and B2.12,” dated August 5, 2020, ADAMS Accession No. ML20218A587.

RAI2-2. Letter from J. Danna (USNRC) to E. Carr (PSEG Nuclear LLC), “Salem Generating Station Unit Nos. 1 and 2 – Authorization and Safety Evaluation for Alternate Request No. SC-I4R-200 (EPID L-2020-LLR-0103),” dated June 10, 2021, ADAMS Accession No. ML21145A189.

RAI2-3. *Technical Bases for Inspection Requirements for PWR Pressurizer Head, Shell-to- Head and Nozzle-to-Vessel Welds*. EPRI, Palo Alto, CA: 2019. 3002015905, ADAMS Accession No. ML21021A271.

RAI2-4. Structural Integrity Associates Report DEV1806.402, ***PROMISE*** *2.0 Theory and User’s Manual*, Revision 1.

RAI 3

In Table 4 of Attachment 1 to the licensee's submittal, the licensee provided the inspection history of the pressurizer welds in scope of the alternative request for Calvert Cliffs 1 and 2. Table 4 shows that upper and lower shell welds 2-401B and 2-401C for both units have no documented examination history. In footnote 4 of Table 4, the licensee states that, for Successive Inspection Intervals, ASME Section XI requires only 1 foot of weld to be volumetrically examined. The staff notes that compliance with ASME Section XI requirements does not imply that the generic PFM evaluation in EPRI Report 3002015905 is an appropriate basis for inspection relief for the subject welds.

The NRC staff has previously addressed conclusions in EPRI Report 3002015905 that are based upon PFM evaluations of the PSI-only case, since PSI-only examination does not account for performance monitoring (see Section 10 of "Salem Generating Station Unit Nos. 1 and 2 – Authorization and Safety Evaluation for Alternative Request No. SC-I4R-200 (EPID L-2020-LLR-0103)," ADAMS Accession No. ML21145A189). An appropriate technical basis should include a discussion for why the analyzed examination histories in the EPRI report are a reasonable representation of the actual examination histories. Also, the staff notes that footnote 4 of Table 4 does not provide a complete explanation of the ASME Section XI requirements that led to no documented examination history for the subject welds.

a) Provide a technical basis related to examination history, irrespective of compliance with Section XI requirements, for why the generic PFM in EPRI Report 3002015905 is an appropriate basis for inspection relief for upper and lower shell welds 2-401B and 2-401C at Calvert Cliffs 1 and 2.

b) Provide an expanded explanation of the ASME Section XI requirements related to upper and lower shell welds 2-401B and 2-401C, including specific reference to relevant ASME Section XI paragraphs.

RESPONSE TO a)

As shown in Table 4 of the Request for Alternative, there are four Item No. B2.12 welds at Calvert Cliffs Unit 1 and four Item No. B2.12 welds at Calvert Cliffs Unit 2. The Weld IDs are identical for both units (2-401A, 2-401B, 2-401C and 2-401D). For both Units 1 and 2, a one-foot segment of Weld IDs 2-401A and 2-401D were inspected during successive inspection intervals per the requirements of ASME Code, Section XI. No examinations have been performed during successive inspection intervals on Weld IDs 2-401B or 2-401C at either unit. Greater than 90% coverage was achieved during the inspections of Weld IDs 2-401A and 2-401D at Units 1 and 2 for those inspections where this information is available. The length of each weld is approximately 155 inches. Since the four welds in each unit are considered to be part of the same population, inspecting two one-foot segments is equivalent to inspecting 3.9% of the total weld volume (i.e., 3.9% coverage at each unit).

PFM evaluations were performed using Version 2.0 of the **PROMISE** software code to determine the probabilities of rupture and leakage with 3.9% coverage of these welds. Both plants have also had at least four 10-year ISI inspections and therefore the plant-specific inspection scenario of (PSI+10+20+30+40+70) was used for both units. For comparison, evaluations were also performed for the current ASME Code, Section XI

mandated inspection interval of (PSI+10+20+30+40+50+60+70). Since the welds are shell welds, a flaw density of 1.0 was used in the evaluation, consistent with Section 9.6 of Reference [RAI3-1]. A fracture toughness of 200 ksi√in with a standard deviation of 5 ksi√in was used in this evaluation, consistent with Section 10.0 (page 19) of Reference [RAI3-1]. As explained in the response to RAI 2, the geometry of Calvert Cliffs compared to the geometry used in the model of the EPRI report results in a reduction in the stress multiplier. A stress multiplier of 0.88 corresponding to that of the main shell of the pressurizer (from Table RAI2-3) was used in the evaluation.

The results are shown in Table RAI3-1. As seen in this table, the probabilities of rupture and leakage are below the acceptance criteria by at least an order of magnitude. When the results are compared to those of the ASME Code, Section XI inspection schedule, they are about the same. This shows that the risk in inspecting only two one-foot lengths of the two welds per unit does not increase the risk when the inspection schedule in the Request for Alternative is used in lieu of the current ASME Code, Section XI schedule.

Table RAI3-1
Sensitivity Study for ISI Examination Coverage for Calvert Cliffs Units 1 and 2
Weld IDs 2-401A, 2-401B, 2-401C and 2-401D

Unit	Component	Stress Path ID	ASME Section XI Inspection Interval 0,10,20,30,40,50,60,70 Flaw density = 1.0 K = 200 ksi√in, SD = 5 ksi√in Stress multiplier = 0.88		Alternate Inspection Interval 0,10,20,30,40,70 (Unit 1) 0,10,20,30,40,50, 70 (Unit 2) Flaw density = 1.0 K = 200 ksi√in, SD = 5 ksi√in Stress multiplier = 0.88	
			Probability of Rupture	Probability of Leakage	Probability of Rupture	Probability of Leakage
1, 2	2-401ABCD	PRSHC-BW-2A	1.25E-09	1.25E-09	1.25E-09	1.25E-09
1, 2	2-401ABCD	PRSHC-BW-2C	1.25E-09	1.17E-07	1.25E-09	1.30E-07

RESPONSE TO b)

Weld IDs 2-401A, 2-401B, 2-401C and 2-401D are longitudinal shell welds classified under ASME Code, Section XI as “Examination Category B-B, Pressure Retaining Welds in Vessels Other Than Reactor Pressure Vessels”. The ASME Code, Section XI Item No. for these welds is B2.12. The inservice examination requirements for these welds are provided in Table IWB-2500-1 (B-B), Item No. B2.12 of the 2013 Edition of ASME Section XI. Weld IDs 2-401A and 2-401B are located at the upper shell of the pressurizer while Weld IDs 2-401C and 2-401D are located at the lower shell.

Table IWB-2500-1 (B-B), Item No. B2.12 states that for successive inspection intervals, examination of only one-foot of one weld per head is required. Note 2 of the table indicates that the weld selected for successive examination shall be the one intersecting the circumferential weld. As required by Table IWB-2500-1 (B-B), Item B2.12 for the successive inspection intervals Exelon examined one-foot of one of the two welds of the upper shell (Weld ID 2-401A) and one-foot of one of the two welds of the lower shell (Weld ID 2-401D). The examination results are summarized in Table 4 of the Request for Alternative.

REFERENCES FOR RAI 3

RAI3-1. Letter from J. Danna (USNRC) to E. Carr (PSEG Nuclear LLC), “Salem Generating Station Unit Nos. 1 and 2 – Authorization and Safety Evaluation for Alternate Request No. SC-I4R-200 (EPID L-2020-LLR-0103),” dated June 10, 2021.

RAI3-2. ASME Boiler and Pressure Vessel Code, Section XI, 2013 Edition “Rules for Inservice Inspection of Nuclear Power Plant Components.”