

April 29, 2022

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

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: Supplemental 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)
  - 3) Letter from D. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information - Proposed Alternative for Examination of Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds," dated November 16, 2021 (ML21320A242)
  - 4) Letter from D. Gudger (Constellation Energy Generation, LLC) to U.S. Nuclear Regulatory Commission, "Supplemental Information - Proposed Alternative for Examination of Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds," dated March 10, 2022 (ML22069A580)
  - 5) Email from J. Wiebe (U.S. Nuclear Regulatory Commission) to T. Loomis (Constellation Energy Generation, LLC), "Braidwood and Byron - Final RAI Regarding Proposed Alternative for Various Pressurizer Welds (EPID L-2021-LLR-0035 and 0036)," dated April 1, 2022 (ML22091A085)
  - 6) Email from A. Mayer (U.S. Nuclear Regulatory Commission) to T. Loomis

(Constellation Energy Generation, LLC), "Calvert Cliffs - Formal RAI for Proposed Alternative for Examinations of Certain Pressurizer Welds (EPID L-2021-LLR-0037)," April 1, 2022 (ML22091A239)

- 7) Letter from D. Gudger (Constellation Energy Generation, LLC) to U.S. Nuclear Regulatory Commission, "Supplemental Information - Proposed Alternative for Examination of Pressurizer Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel Welds," dated April 8, 2022 (ML22098A179)
- 8) Email from J. Wiebe (U.S. Nuclear Regulatory Commission) to T. Loomis (Constellation Energy Generation, LLC), "Braidwood/Byron Verbal Authorization for Proposed Alternative I4R-15/I4R-21," dated April 15, 2022

In the Reference 1 letter, Constellation Energy Generation, LLC (CEG) (previously Exelon Generation Company, LLC) requested relief from the examination of pressurizer circumferential and longitudinal shell-to-head welds and nozzle-to-vessel welds for Braidwood Station, Units 1 and 2, Byron Station, Units 1 and 2, and Calvert Cliffs Nuclear Power Plant, Units 1 and 2 (Calvert Cliffs). In the Reference 6 email, the U.S. Nuclear Regulatory Commission requested additional information for Calvert Cliffs. The Reference 1 relief request is supported by the evaluations and conclusions presented in EPRI Report 3002015905 and is summarized as follows:

- A comprehensive industry survey involving 47 PWR units (US and international) was conducted by EPRI to determine the degradation history of these components. The survey reviewed examination results from the start of plant operation. Most of these plants have operated for over 30 years and in some cases over 40 years. Of the plants surveyed, 269 examinations have been performed on each of Item Numbers B2.11 and B2.12 and 590 examinations have been performed on Item Number B3.110. The survey results showed that no examinations identified any unknown degradation mechanisms (i.e., mechanisms other than those listed in Section 6.0 of the EPRI Report). No flaws have been identified for Item Numbers B2.12 or B3.110 and only 4 examinations for Item Number B2.11 identified flaws exceeding the acceptance criteria of Section XI. All these flaws have been analytically evaluated and there has been no change in the flaw size since the original evaluation. As shown in the proposed alternative, Calvert Cliffs Units 1 and 2 have not identified any unacceptable indications in the Item Number B2.11, B2.12, and B3.110 components during the service life of the pressurizers. Based on this exhaustive industry survey, it is concluded that although the emergence of an unknown degradation mechanism cannot be completely ruled out, the possibility of the occurrence of such an unknown degradation mechanism is highly unlikely.
- The deterministic fracture mechanics (DFM) evaluation presented in Section 8.2 of the EPRI Report indicates that it would take a minimum of 433 years for a postulated initial flaw (with a depth equal to the ASME Code, Section XI acceptance standards) in the pressurizer welds to reach 80% through-wall (assumed as leakage). The

maximum stress intensity factor (K) obtained from the analysis remained below the ASME Code, Section XI allowable fracture toughness. This demonstrates that the pressurizer components are very flaw tolerant.

- Demonstrating plant specific applicability of the EPRI report along with the probabilistic fracture mechanics (PFM) evaluations presented in Section 8.3 of the EPRI report, as supplemented by the CEG RAI responses (ADAMS Accession No. ML21320A242), indicate that the pressurizer welds at Calvert Cliffs can operate safely for over 80 years.
- The proposed inspection deferrals for Calvert Cliffs are an order of magnitude lower (18.5 years vs 433 years) than those justified by the results of the DFM and the PFM evaluations in the EPRI Report. These conservative inspection deferrals provide defense-in-depth for the analytically determined safe operating period.
- Operating conditions at Calvert Cliffs have been satisfactory over the life of the Pressurizers and are bounded by the analysis in the EPRI Report. As shown in Table C-5 and C-6 of Reference 1, and supplemented by the CEG RAI response, the number of actual transient cycles experienced by Calvert Cliffs for most analyzed transients is significantly less than what was evaluated in the EPRI report. In the case of Calvert Cliffs Unit 1, the number of Reactor Trips is projected to exceed the number of cycles evaluated in the EPRI Report (171 cycles vs 164 cycles). However, the latest fatigue analysis determined that the fatigue usage remains below the allowable limit of 1.0 for all monitored locations for Calvert Cliffs Unit 1. This adds an additional layer of confidence in the extension of the pressurizer weld inspections.

The CEG position is that the most recent examinations at Calvert Cliffs Unit 1 (2020) and Unit 2 (2021) have fulfilled the requirements for performance monitoring as discussed below.

As shown in Table 1 of Reference 1, Calvert Cliffs Unit 1, Category B-D, Item B3.110 requests the greatest length of deferral, 18.5 years, from the last ASME Section XI Inspection. This corresponds to a period of less than two ASME XI inservice inspection intervals. The substantial satisfactory inspection history provided in Table 4 of the proposed alternative has provided sufficient direct visual evidence of the absence of any unacceptable degradation in the Calvert Cliffs Units 1 and 2 components throughout the course of plant operation. Calvert Cliffs Unit 2 performed examination of Item Number B2.11 (1 total), B2.12 (1 total), and B3.110 (4 total) components as recently as the 2021 refueling outage. Calvert Cliffs Unit 1 performed examination of Item Number B2.11 (1 total) and B2.12 (1 total) components as recently as the 2020 refueling outage and performed examination of Item Number B3.110 (2 total) components as recently as the 2016 refueling outage. Except for the 2016 Unit 1 examinations, the most recent examinations were performed during the current 5<sup>th</sup> inservice inspection interval. Completion of eight (8) examinations during the 5<sup>th</sup> inservice inspection interval accounts for half of the ASME Section XI required inspections for the interval for the combined units. It should be noted that the current extended operating licenses for Calvert Cliffs Units 1 and 2 expire midway through the 6<sup>th</sup> inservice inspection interval. CEG's position is that completion of these examinations in the 5<sup>th</sup>

inservice inspection interval has fulfilled the requirements for performance monitoring. Given the relative short duration of the proposed deferral (18.5 years) compared to the analytically determined safe operating period (433 years) and the satisfactory inspection history for the components covered by the proposed alternative, CEG maintains that the strong technical basis provided by demonstrating compliance with the EPRI Report, as supplemented by the CEG RAI response (ADAMS Accession No. ML21320A242), provides sufficient justification to support deferral of the ASME Section XI examinations for the remainder of the current extended operating license.

In the Reference 7 letter, CEG provided a performance monitoring plan for the Byron and Braidwood pressurizer components. This performance monitoring is to be completed in a time such that no more than 20 years elapses between the performance of an ASME Section XI examination for the Byron Unit 2 pressurizer components that will be inspected as part of the performance monitoring plan. This proposed performance monitoring plan was approved in the Reference 8 verbal authorization. Given that the time between the last ASME Section XI examination and the end of the current operating license for Calvert Cliffs Units 1 and 2 does not exceed 18.5 years, CEG's plan to perform no additional performance monitoring examinations for the remainder of the current extended operating license for Calvert Cliffs Units 1 and 2 is more conservative than the previous approval for Byron and Braidwood.

In addition to the direct evidence provided by examinations performed to date, examination of Category B-B and Category B-D pressurizer components is expected to continue to be performed by other units across the domestic and international PWR fleet. These examinations will provide additional monitoring and opportunities to detect any degradation in the components covered by the proposed alternative. Continued examination of Category B-B and Category B-D pressurizer components across the industry will provide additional opportunities to detect known degradation mechanisms, as described in Section 6.0 of the EPRI report, and will also provide the opportunity to detect any new or unexpected degradation mechanisms that may occur in the future for the subject components. If a new degradation mechanism is identified during continued industry examinations, CEG will follow the industry guidance to address this new degradation mechanism.

The strong technical basis provided by the results of the PFM Model and EPRI Report along with the satisfactory inspection history and relatively short duration of the proposed examination deferrals compared to the analytically determined safe operating period provide sufficient assurance that the pressurizer welds at Calvert Cliffs Units 1 and 2 can operate safely for the remainder of plant life and will continue to provide an acceptable level of quality and safety.

No regulatory commitments are contained in this letter.

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

Supplemental Information - Proposed Alternative for Examination of Pressurizer  
Circumferential and Longitudinal Shell-to-Head Welds and Nozzle-to-Vessel  
Welds

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Respectfully,



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