

From: [Natreon Jordan](#)
To: [Diane Curran](#); h templeton@foe.org
Subject: Initial Assessment for Mothers For Peace and Friends of the Earth 2.206 Petition Regarding Diablo Canyon
Date: Friday, March 08, 2024 3:39:00 PM

Ms. Curran,

The Petition Review Board (PRB) has completed its initial assessment of the petition you submitted on September 14, 2023, on behalf of San Luis Obispo Mothers for Peace and Friends of the Earth. Your submittal requested in part that the U.S. Nuclear Regulatory Commission (NRC) issue an emergency order requiring immediate shutdown of the Diablo Canyon Nuclear Plant (Diablo Canyon), Unit 1 facility pending completion of tests and inspections of the pressure vessel, public disclosure of results, public hearing, and determination by the Commission that Unit 1 can safely resume operation. The Secretary of the Commission, in denying your request for hearing, referred your request for immediate closure of Diablo Canyon and the associated underlying concerns for consideration under Title 10 of the Code of Federal Regulations (10 CFR), Section 2.206. To support your request, you provided the following concerns in the petition along with a specified recommendation for staff to consider the following:

1. The license amendment issued by the NRC staff to Pacific Gas and Electric Co. (“PG&E”) by letter of July 20, 2003, extending the schedule for conducting surveillance of the Diablo Canyon Unit 1 pressure vessel until 2025 poses an unreasonable risk to public health and safety.
2. Licensee committed violations by not properly monitoring the condition of the Reactor Pressure Vessel (RPV) (Section 7 of petition)
3. PG&E has repeatedly postponed additional surveillance and testing of the pressure vessel
4. The licensee should implement Dr. McDonald’s independent analysis-based recommendations regarding RPV integrity

The PRB performed its initial assessment to determine whether the above RPV concerns in your petition meet the applicable acceptance criteria in NRC’s Management Directive (MD) 8.11, “Review Process for 10 CFR 2.206 Petitions,” and its associated Directive Handbook (DH) 8.11, Section III.C.1 (Agencywide Documents Access and Management System (ADAMS) Accession number ML18296A043).

The PRB’s initial assessment is that the RPV concerns and recommendation in your petition do not meet the DH 8.11 acceptance criteria in Section III.C.1(b)(ii), which includes “The issues raised have previously been the subject of a facility-specific or generic NRC staff review...” and the petition does not provide significant new information that the staff did not consider in the prior review. The result of our initial assessment is to not accept your petition for review.

Specifically, the concerns listed in your petition are known to the NRC staff and were previously considered in the development of the July 20, 2023, NRC-issued approval of the Diablo Canyon Unit 1 RPV surveillance capsule withdrawal schedule (ML23199A312). These concerns do not represent a regulatory non-compliance that may constitute the basis for shutting down the Diablo Canyon, Unit 1 facility.

Below, the PRB has provided a summary of the “General Background on Appendix H and RPV Embrittlement.” In addition, the PRB has addressed your concerns in detail and provided a response to the recommendation included in the petition.

PRB Response

General Background on App H and RPV Embrittlement

A reactor vessel material surveillance program, as required by Appendix H to 10 CFR Part 50 (Appendix H), monitors the changes in mechanical and material properties of the reactor pressure vessel (RPV). This is accomplished by including capsules that contain test specimens (e.g., Charpy and tensile) made of the same material as the RPV and monitoring materials (e.g., temperature monitors and dosimetry). The capsules are located inside the RPV closer to the core than the inside wall of the RPV. Based on their location, the amount of neutron fluence received by these capsules typically exceeds that received by the RPV wall itself. Therefore, the test results from the specimens within the surveillance capsule experience the same operating conditions as the RPV wall, but at higher levels of neutron irradiation. These test specimens will reflect changes in fracture toughness due to neutron embrittlement in advance of the RPV, providing insight to the future condition of the RPV. This practice allows for the collection of bounding test data regarding the change in mechanical and material properties of the RPV following irradiation. The NRC staff can use this information to analyze the integrity of the RPV.

1. **The license amendment issued by the NRC staff to Pacific Gas and Electric Co. (“PG&E”) by letter of July 20, 2003, extending the schedule for conducting surveillance of the Diablo Canyon Unit 1 pressure vessel until 2025 poses an unreasonable risk to public health and safety.**
2. **Licensee committed violations by not properly monitoring the condition of the Reactor Pressure Vessel (RPV) (Section 7 of petition)**

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PRB Response:

As described in the NRC staff’s assessment dated July 20, 2023 (ML23199A312), the licensee has withdrawn and tested a total of three surveillance capsules (i.e., Capsules S, Y, and V) for Diablo Canyon, Unit 1, which fulfilled its reactor vessel material surveillance requirements in Appendix H for the current 40-year operating license period. In particular, the final capsule required for the current operating license period (i.e., Capsule V) received an estimated neutron exposure greater than the RPV is expected to receive at the end of the current 40-year operating license period. Thus, the licensee obtained surveillance data representative of the RPV beyond the end of its the current operating license period. The required test results from Capsule V are documented in WCAP-15958, “Analysis of Capsule V from Pacific Gas & Electric Co Diablo Canyon Unit 1 Reactor Vessel Radiation Surveillance Program” - (Package ML031400352). As described in section 4.2.2.2 of the staff’s safety evaluation report (SER) dated June 2, 2011, ML11153A103, it was estimated that the Diablo Canyon, Unit 1 RPV will not reach the pressurized thermal shock screening criteria in 10 CFR 50.61 until approximately the year 2032. Additionally, measures are available to licensees as described in 10 CFR 50.61(b)(2) through (7) or 10 CFR 50.61a, “Alternate fracture toughness requirements for protection against pressurized thermal shock events” for addressing pressurized thermal shock.

It is also noted that the licensee’s current Pressure-Temperature Limits documented in Revision 16a of its pressure-temperature limit report (PTLR) (ML23298A107) are applicable beyond the current 40-year operating license period (i.e., through 35 Effective Full Power Years) and the PTLR incorporated relevant surveillance data consistent with the staff’s position on considering all data relevant to RPV integrity described in Generic Letter 92-01.

Surveillance capsules inserted in the RPV, beyond those required by Appendix H and

recommended by ASTM E 185, are often referred to as “standby” capsules. The NRC staff’s assessment dated July 20, 2023, was associated with revising the status of Capsule B from a “standby” capsule to be withdrawn in 1R24 refueling outage (fall 2023) or the 1R25 refueling outage (spring 2025). Specifically, as indicated in the approval of the supplemental surveillance program on September 4, 1992 (ML16341G687), Capsule B was intended to be removed and tested when the accumulated fluence is equivalent to the vessel inside surface at 48 Effective Full Power Years (i.e., operation of the plant well beyond the original 40-year design). Thus, as part of the licensee’s current licensing basis for Diablo Canyon, Unit 1, the withdrawal, and testing of Capsule B is not required to demonstrate compliance with Appendix H during its current operating 40-year license period.

In addition to monitoring the changes in fracture toughness properties of the RPV in accordance with Appendix H, and addressing RPV integrity in accordance with Appendix G to 10 CFR Part 50 and 10 CFR 50.61, licensees are required to perform non-destructive examinations of the RPV in accordance with 10 CFR 50.55a, or any approved alternatives granted in accordance with 10 CFR 50.55a(z).

3. PG&E has repeatedly postponed additional surveillance and testing of the pressure vessel

NRC Response:

As discussed above, U.S. nuclear plants typically have surveillance capsules inserted in the RPV beyond those required by Appendix H and recommended by ASTM E 185. These are often referred to as “standby” capsules. There are at least five such “standby” capsules at Diablo Canyon, Unit 1.

As previously described, the final capsule required for the current operating license period, Capsule V, was withdrawn and tested, which provided surveillance data representative of the reactor vessel beyond the end of its the current 40-year operating license period. The NRC reviewed and approved each instance in which the withdrawal and testing of Capsule B was rescheduled (e.g., September 24, 2008 – ML082380306, October 29, 2010 - ML103010159, March 2, 2012 - ML120330497, July 20, 2023 - ML23199A312). These approvals were based on Capsule B (i.e., “license renewal capsule”) addressing the surveillance data needs to support plant operation beyond the current 40-year operating license period and is consistent with the recommendations discussed in NUREG-1801, “Generic Aging Lessons Learned (GALL) Report”.

The licensee is not required under Appendix H to withdraw their “license renewal capsule” to support their current operating license, as all required capsules for Diablo Canyon, Unit 1 have already been withdrawn and tested, as discussed in NRC’s letter dated July 20, 2023. However, if a renewed license is issued for Diablo Canyon, this “license renewal capsule” would become required under Appendix H to support the renewed operating license.

The licensee will be required to withdraw the capsule on the date specified in the NRC approved schedule. Once withdrawn, it must be tested, and the results provided to the NRC within 18 months, consistent with the requirements of Appendix H. The withdrawal and testing of the “license renewal capsule” is not required to be completed prior to issuing a

renewed license. Consistent with 10 CFR Part 54.29, which states that a renewed license may be issued by the NRC if it finds that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components required to be addressed by 10 CFR Part 54. It is incumbent on the licensee to demonstrate that the effects of neutron embrittlement of the RPV will be adequately managed during the period of extended operation in its License Renewal Application. The staff's review of the licensee's actions with respect to managing the effects of embrittlement of the RPV required by 10 CFR Part 54 will be part of the review of the licensee's License Renewal Application.

4. Dr. McDonald's independent analysis-based recommendations regarding RPV integrity.

While the PRB recognizes the efforts by Dr. McDonald highlighted in the petition, the merits of Dr. McDonald's recommendations do not justify a change to the NRC's already conservative approach to assessing the integrity of the RPV.

In the discussion below, the PRB has provided detailed responses to petition concerns regarding the evaluation and inspection pertaining to the RPV.

a) Withdrawal and analysis of the contents of Capsule B as well as Capsules C and D (previously withdrawn but not analyzed).

PRB Response:

Capsules B, C and D are "standby" capsules at Diablo Canyon, Unit 1. The licensee is not required under Appendix H to withdraw or test these standby capsules to support the current 40-year operating license as all required capsules for Diablo Canyon's current operating license have already been withdrawn and tested, as discussed in NRC's letter dated July 20, 2023.

As described above, Capsule B was intended to be removed and tested when the accumulated fluence is equivalent to the vessel inside surface at 48 Effective Full Power Years (i.e., operation of the plant beyond the original 40-year design) and is not required to demonstrate compliance with Appendix H during its current 40-year operating license period.

With respect to Capsule C and D, as indicated in the approval of the supplemental surveillance program on September 4, 1992, they were intended to be removed and tested when the accumulated fluence is equivalent to the RPV inside surface at 32 Effective Full Power Years in order to demonstrate the toughness recovery after thermal annealing and the degree of re-embrittlement after thermal annealing, respectively. As described in FSAR Table 5.2-22, Capsules C and D were removed in Refueling Outage 12 and placed in storage since there are currently no industry plans to anneal reactor vessels, which is described in FSAR Section 5.2.2.4.4. Should these plans change in the future regarding thermal annealing, the contents from Capsule C and D are still available to the licensee to demonstrate the toughness recovery after thermal annealing and the degree of re-embrittlement after thermal annealing, respectively, for the Diablo Canyon, Unit 1 RPV.

b) Evaluation and analysis of the wedge opening loading specimens contained in Capsules B, C and D and the archived capsules.

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c) Performance of nano indentation studies on the fractured remnants of the Charpy specimens from Capsules S, Y, and V.

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PRB Response:

Appendix H requires that for each capsule withdrawal, the test procedures and reporting requirements must meet ASTM E 185–82 to the extent practicable for the configuration of the specimens in the capsule. Sections 9 and 11 of ASTM E185-82 specify the required mechanical tests and report contents, respectively. Although the surveillance capsules for Diablo Canyon, Unit 1 contain additional test specimens (wedge opening loading specimens for instance), their testing is beyond the requirements of Appendix H. Similarly, additional testing methods, such as nano indentation studies, of the fractured remnants of the Charpy specimens from Capsules S, Y, and V are also beyond the requirements of Appendix H.

The NRC's regulatory framework relies on the use of consensus codes and standards. The required testing specified in ASTM E 185-82, as incorporated by reference in Appendix H, provide the data necessary to adequately assess the integrity of the RPV, and includes conservatism and safety factors that accommodate the use of data from Charpy impact testing. It has not been necessary for the staff to establish testing and reporting requirements beyond those identified in Appendix H and ASTM E185-82.

d) A comprehensive ultrasonic testing (UT) inspection of reactor vessel beltline welds.

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PRB Response:

10 CFR 50.55a(g)(4) establishes the inservice inspection standards requirement for operating plants, which incorporates by reference the inspection requirements from Section XI of the ASME Code. Table IWB-2500-1 of Section XI of the ASME Code provides the examination categories and associated inspection requirements for the components at a nuclear power plant. In particular, Examination Categories B-A, "Pressure-Retaining Welds in Reactor Vessel" and B-D, "Full Penetration Welded Nozzles in Vessels" are the relevant inspection requirements for the RPV and already include requirements to perform volumetric examinations of the reactor vessel welds during each 10-year inservice inspection interval.

Additionally, licensees may propose alternatives to the inspections requirements of 10 CFR 50.55a and must demonstrate that the proposed alternative would either provide an acceptable level of quality and safety or that the alternative is appropriate because compliance with the inspection requirements of 50.55a would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, in accordance with 10 CFR 50.55a(z). The licensee was granted one such alternative as documented in the NRC's Safety Evaluation dated June 19, 2015 (ML15168A024) related to the required volumetric inspections of the reactor vessel pressure-retaining welds.

Furthermore, the operating experience highlighted by the petitioner related to the Doel-3 and Tihange-2 PWRs in Belgium were previously addressed by the NRC staff in letter dated March 29, 2016 (ML16054A691). In summary, the NRC issued Information Notice (IN) 2013-19, "Quasi-Laminar Indications in Reactor Pressure Vessel Forgings," dated September 22, 2013 (ADAMS Accession No. ML13242A263), and assessed the effects of the potential existence of quasi-laminar indications in RPV forgings in all U.S. vessels by

using an approach based on probabilistic fracture mechanics (PFM), and examined them within the context of the NRC's approach to risk-informed decision making described in the Office of Nuclear Reactor Regulation Office Instruction LIC-504, Revision 4, "Integrated Risk-Informed Decision Making Process for Emergent Issues" (ADAMS Accession No. ML14035A143).

e) publication of the data from the 2015 UT inspection of reactor vessel beltline welds.

PRB Response:

As described in FSAR Section 3.1.2.1, the licensee's quality assurance (QA) program conforms with the requirements of 10 CFR Part 50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants, which establishes quality assurance requirements for the design, manufacture, construction, and operation of structures, systems, and components at the nuclear power plant. Detailed information associated with inservice inspection of the RPV is governed by each licensee's QA program which requires that sufficient records be maintained and be identifiable and retrievable.

The detailed information associated with the inservice inspection of the RPV that is required to be submitted to the NRC is specified in 10 CFR 50.55a and Section XI of the ASME Code. In particular, 10 CFR 50.55a(b)(1)(xxxii), "**Section XI condition: Summary report submittal**," requires that plants in commercial service submit Summary Reports and Owner's Activity Reports described in IWA-6230 of Section XI of the ASME code to the NRC within 120 calendar days of the completion of each refueling outage. The submission of detailed RPV beltline weld UT inspection data to the NRC is not required by 10 CFR 50.55a.

f) A robust re-evaluation of the credibility of data from Capsules S, Y, and V that fully complies with NRC guidance and scientific principles:

PRB Response:

As required by Technical Specification Section 5.6.6, "Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)," the Diablo Unit 1 licensee shall use the analytical methods previously reviewed and approved by the NRC to determine the RCS pressure and temperature and Low Temperature Overpressure Protection (LTOP) limits. TS Section 5.6.6.b specifically identifies the following:

- WCAP 14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves."
- Chapter 6.0 of WCAP-15958, "Analysis of Capsule V from Pacific Gas and Electric Company Diablo Canyon Unit 1 Reactor Vessel Radiation Surveillance Program."

Section 2.4 of WCAP 14040-NP-A, Revision 2 (ML15324A233) specifies that the adjusted reference temperature (ART) for the RPV materials is calculated in accordance with Regulatory Guide 1.99, Revision 2, which provides guidance on determining the credibility of the surveillance data.

The staff noted that the specific NRC guidance and scientific principles referenced by the petitioner contained in "Generic Letter 92-01 and RPV Integrity Assessment, Status, Schedule and Issues (Feb. 12, 1998) (ADAMS Accession No. ML110070570)" is associated with determining weld chemistry values (i.e., percent copper and percent nickel

content) for RPV materials and is not associated with the credibility assessment of surveillance data that is used in calculating adjusted reference temperature.

The licensee's credibility assessment of its surveillance data from Capsules S, Y, and V is documented in Section 5 of Diablo Canyon's PTLR, Revision 16a (ML23298A107), which is applicable through 35 Effective Full Power Years, and was performed in accordance with Regulatory Guide 1.99, Revision 2.

For your awareness, the 2.206 process affords all petitioners the opportunity to clarify or supplement their petitions in a virtual public meeting with the PRB. Should you decide to take advantage of this opportunity, the meeting with the PRB would be conducted consistent with the format described in MD 8.11, Section III.F. The PRB will consider your statements and information presented at the meeting, along with the original petition, in making its final determination on whether to accept your petition for review. Please indicate by March 15, 2024, whether you wish to have this public meeting.

If you have any questions regarding this e-mail, please feel free to contact me at Natreon.Jordan@nrc.gov.

Best Regards,
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