DCISC

DIABLO CANYON INDEPENDENT SAFETY COMMITTEE

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Dear Mr. Severance:

Thank you for the letter you sent to the DCISC dated 18th July 2024 entitled "*Comments to the DCISC Addressing Misrepresentations by Staff at the June 20th Presentation and How NRC Procedure Has Been Violated by PG&E and Westinghouse*" (see Appendix). We are sorry that you feel we misrepresented and/or mischaracterized your positions during the public meeting of 20th June; this was certainly no one's intention. On a topic such as this one, which is both broad in scope and quite detailed, it can be challenging to precisely represent one's own views, let alone those of others. We hope that this letter will bring some clarity to our evaluations.

Before we address the details of your letter, we feel it our responsibility to mention that if you feel NRC procedures have not been followed there is a process available at the NRC to address such concerns. You can petition NRC to take an enforcement action. The details of this process appear at this link https://www.nrc.gov/about-nrc/regulatory/enforcement/petition.html. The DCISC is chartered to independently review safety at Diablo Canyon, not to critique the NRC's procedures. The DCISC uses NRC procedures and technical positions as a reference to support its independent reviews. This includes knowledge of the technical bases for these procedures/positions and of their adoption or use in internationally accepted codes and standards.

In this reply to your letter we have excerpted the concerns you expressed, adopting the numbering scheme you used. Many of your concerns were addressed previously in the following documents:

{Part 1 Rpt}	Kirk report to DCISC, Part 1. https://www.dcisc.org/download/library/an-evaluation-of-the-status-of-diablo-canyon-unit-1/report-part-1-addressing-public-concerns-75.pdf
{Part 2 Rpt}	Kirk report to DCISC, Part 2. https://www.dcisc.org/download/library/an-evaluation-of-the-status-of-diablo-canyon-unit-1/report-part-2-evaluation-of-diablo-canyon-unit-1-embrittlement-76.pdf
{May '24 Ltr}	Kirk's replies to your comments to DCISC made on 15 April 2024. https://www.dcisc.org/download/library/an-evaluation-of-the-status-of-diablo-canyon-unit-1/dr-kirks-replies-to-comments-made-by-mr-bruce-severance-on-april-15-2024-84.pdf

In our reply we will use the short acronyms in the left-hand column to refer to these previous works. The complete and often lengthy discussions from these documents are only synopsized, not repeated, here. Direct citations to sections or figures in these previous documents are provided for clarity.

In comment #1 of your letter of 18th July you state, in part, the following:

(a) *Dr. Kirk and now Dr. Kadak's assert, that "sister data is required to be integrated using Equation 5" is not substantiated and appears nowhere in the NRC regulations.*

(b) *Dr. Kirk claims an exemption for integration of "sister plant data" that is contrary to the integrated surveillance program (ISP) criteria as defined by 10 CFR 50, Appendix H. It is argued by your staff that Palisades and DCPP-1 are not participants in an ISP program and that they are exempt from Appendix H requirements, that the similarity of plant design, and operating conditions such as fuel configuration, operation at partial power and the use of shielding to reduce neutron bombardment need not be considered. Nothing in the regulations actually states this. It is gaslighting to suggest that NRC procedures requires "integration of sister plant data" as Dr. Kirk has asserted, when the term "sister plant" is not even defined in the regulations.*

Concerning part (a) of your comment, you are correct to point out that the term "sister plant" or "sister data" appears nowhere in regulations, which was stated in Section 2.4.4.1 of the {Part 1 Rpt}. That section of that report also describes the data that must be used, following NRC's procedures, to estimate the values of ΔT_{41J} that are used in a PTS assessment. Section 2.4.4.1 explains that [10CFR50.61][1] (the PTS rule) requires (it is a requirement because the regulation uses the word "shall") licensees to consider "*Surveillance program results means any data that demonstrated the embrittlement trends for the limiting beltline material, including but not limited to data from test reactors or from surveillance programs at other plants with or without surveillance program integrated per 10 CFR Part 50 Appendix H.*" Section 2.4.4.1 further states that the NRC issued guidance in [Wichman 1998] to clarify this statement. Information in [Wichman 1998] interprets this language from [10CFR50.61] to mean that utilities should consider data having the same weld wire heat number from other plants. Information from [Wichman 1998] makes clear that the NRC considers surveillance data collected from the same weld wire heat but exposed to irradiation in other plants to be equivalent to data obtained from the plant of interest (in this case: Diablo Canyon Unit 1). Finally, this section points to [EPRI 1993] as the origin of the terms "sister plant" and "sister data," which mean data from the same weld wire heat.

Part (b) of your comment was addressed directly in {May '24 Ltr}, please see the comments headed "Page 6, Item N" which begin on the bottom of page 12 of that document. As stated in {May '24 Ltr}, the use of sister plant data, which was just discussed, is *required* by [10CFR50.61]. Such use is not evaluated in the same way as an integrated surveillance program, which is a coordinated data sharing arrangement between multiple plants. The requirements for an integrated surveillance program appear in Section III(C) of [10CFR50-AppH]. Many plants use sister plant data to provide additional information on their irradiation embrittlement trends. There is no example for any plant that has used sister plant data being subjected to the NRC reviews needed to implement an integrated surveillance program.

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[1] Citations enclosed in square brackets appear in the referenced documents; they are not repeated here.

In comment #2 of your letter of 18th July you state, in part, the following:

> *Dr. Macdonald is correct to question how the sister plant data is integrated and whether all variables are "captured" by the temperature adjustment equations as Dr. Kirk suggests. Clearly, the operating conditions and design are vastly different, and temperature adjustment equations would not capture variables such as the use of neutron bombardment shielding in the Palisades fuel racks that could significantly alter the neutron bombardment experienced by the most vulnerable section of the axial welds at Palisades.*

Section 3.2.4.2 of the {Part 1 Rpt} directly addresses this concern in detail. You are correct to point out that the operating conditions are not identical between Diablo Canyon Unit 1 and Palisades. However, as stated in Section 3.2.4.2 of the {Part 1 Rpt} there is no evidence in the now considerable database of surveillance information that has been collected and extensively analyzed by ASTM [ASTM Adjunct] that these various plant-to-plant differences contribute to embrittlement as quantified by ΔT_{41J} to a magnitude that rises above the scatter inherent to the data. The one variable affecting ΔT_{41J} to a magnitude above scatter is temperature, which is accounted for by the NRC's analysis protocols, see [Wichman 1998] and Figure 10 of {Part 1 Rpt}. Please also note that the key variable controlling embrittlement is the number of neutrons hitting the specimen, which is quantified by the value of fluence. Estimated fluence values for both the vessel and the surveillance capsule are calculated based on measurements from reactor vessel dosimetry samples and take account of plant-specific factors such as shielding that may occur as a consequence of the design, fuel management strategies, or other factors. Thus, the fact that the Palisades plant may have employed different shielding strategies than have been implemented at Diablo Canyon Unit 1 is accounted for by the estimated fluence values.

In comment #3 of your letter of 18th July you state, in part, the following:

> (a) *It is abundantly clear that ASTM E185-70 Table 1 required an amendment to a 5-capsule program by 1987. Because of the very early detection of a rapid embrittlement trajectory, the regulations did in fact require more data which PG&E, the NRC and now the DCISC have denied.*
>
> (b) *Dr. Budnitz's position is to simply state that in absence of further data you wish to proceed with endorsement of the Kirk Reports without acknowledging that the regulations clearly state that integration of data between to ISP-participating plants cannot substitute for or reduce the required surveillance testing (1995 Update to 10 CFR 50, Appendix H, Federal Register, Dec. 19, 1995, Vol.60, #243, pg. 65476).*

Part (a) of your comment was addressed in detail in Section 2.1.1 of {Part 2 Rpt}, which stated that Diablo Canyon Unit 1, for which construction began in 1968, was licensed to ASTM E185-70 which does not include Table 1. Table 1 was first included in 1979 when then standard was updated to ASTM E 185-79. Since the Diablo Canyon plant was licensed to ASTM E185-70, its surveillance program need not comply with the requirements of Table 1. Section 2.3.1 of {Part 2 Rpt} goes on to summarize the various modifications to the withdrawal schedule for Capsule B and makes clear that the NRC has, on numerous occasions, re-affirmed that Diablo Canyon Unit 1 is a 3-capsule plant for its first licensing period (first 40 years). Section 2.3.2 of {Part 2 Rpt} goes on to describe how these requirements may change if Diablo Canyon Unit 1 is granted a 20-year license renewal by the NRC (Diablo Canyon's license renewal application is still under NRC review).

For reference, Figure 1 on the next page contains images of the surveillance capsule withdrawal schedule recommendations from ASTM E185-70 (top) and as they were modified in ASTM E185-79 (bottom). It is the 1979 requirements to which you and Dr. Macdonald repeatedly refer, but these requirements do not pertain to Diablo Canyon Unit 1 during its first 40-year licensing term. Despite the licensing requirement of needing only 3 capsules for 40 years, the analysis presented in Section 3.1.1 of the {Part 2 Rpt} employs 5 data points, which include the 3 Diablo Canyon capsules and the 2 Palisades sister plant capsules. This analysis reaches the same conclusions concerning PTS as presented in [WCAP-17315]. As discussed in Section 4.1.1. of the {Part 2 Rpt}, 6 more data similar to the Diablo Canyon weld are available from German plants. These data have not been used directly in our analysis, but nevertheless support our assessment of PTS acceptability to beyond 60-years.

ASTM E185-70

4.6 *Specimen Withdrawal*—It is recommended that sets of specimens be withdrawn at three or more separate times. One of the data points obtained shall correspond to the neutron exposure of the reactor vessel at no greater than 30 percent of its design life. One other data point obtained shall correspond to the neutron exposure of the reactor vessel near the end of its design life.

ASTM E185-79

TABLE 1 Minimum Recommended Number of Surveillance Capsules and Their Withdrawal Schedule (Schedule in Terms of Effective Full-Power Years of the Reactor Vessel)

	Predicted Transition Temperature Shift at Vessel Inside Surface		
	≤ 56°C (≤ 100°F)	> 56°C (> 100°F) ≤ 111°C (≤ 200°F)	> 111°C (> 200°F)
Minimun Number of Capsules	3	4	5
Withdrawal Sequence:			
First	6[A]	3[A]	1.5[A]
Second	15[B]	6[C]	3[D]
Third	EOL[E]	15[B]	6[C]
Fourth		EOL[E]	15[B]
Fifth			EOL[E]

[A] Or at the time when the accumulated neutron fluence of the capsule exceeds 5×10^{22} n/m^2 (5×10^{18} n/cm^2), or at the time when the highest predicted ΔRT_{NDT} of all encapsulated materials is approximately 28°C (50°F), whichever comes first.

[B] Or at the time when the accumulated neutron fluence of the capsule corresponds to the approximate EOL fluence at the reactor vessel inner wall location, whichever comes first.

[C] Or at the time when the accumulated neutron fluence of the capsule corresponds to the approximate EOL fluence at the reactor vessel ¼ T location, whichever comes first.

[D] Or at the time when the accumulated neutron fluence of the capsule corresponds to a value midway between that of the first and third capsules.

[E] Not less than once or greater than twice the peak EOL vessel fluence. This may be modified on the basis of previous tests. This capsule may be held without testing following withdrawal.

Figure 1: Capsule withdrawal schedule recommendations from ASTM E185-70 (top) and ASTM E185-79 (bottom).

Part (b) of your comment repeats your concern that the NRC has allowed Diablo Canyon Unit 1 to use sister plant data without proper reviews that are associated with an integrated surveillance program (ISP). This is the same concern as you stated in your comment #1(a). Please see our response earlier in this letter.

In comment #4 of your letter of 18th July you state, in part, the following:

(a) Dr. Macdonald clearly stated, and correctly cited the NRC regulations when he suggested that Table 1 of ASTM E185-70 requires a 5-capsule program if it is found in early capsule tests that an RPV is on a trajectory that indicates an RT-NDT delta exceeding 200F. Dr. Kadak was gaslighting when he asserted that Table 1 doesn't state that. It is clearly shown in Table 1 that an RPV headed for greater than 200F difference in RT-NDT (aka "shift") must be amended to a 5-capsule program. The fact that this NRC procedure was not followed in 1987 is consequential. Although Diablo Canyon was initially approved for a 3-capsule surveillance program in its original license, the results of the 1987 Capsule S results SHOULD have triggered an amendment to the surveillance program and additional capsules containing the most limiting weld material (heat#27204) SHOULD have been added at that time.

(b) Now the DCISC committee is both asserting that we should wait for the Capsule B tests to make further assessment, and they argue that the Mini-CT testing is invalid or unacceptable for retesting of the Capsule S, V & Y samples already in hand.

Part (a) of your comment repeats your concern about the number of capsules in the Diablo Canyon Unit 1 surveillance program that you previously stated as comment #3(a). Please see our response earlier in this letter. Your additional assertation that the results of the first capsule test (Capsule S) should have triggered an amendment to the surveillance program is not correct. There is no NRC requirement nor precedent for such an amendment. Additionally, it may be noted (see the second graph from the top of Figure 2 in {Part 2 Rpt}) that the Capsule S datum lies somewhat below the NRC's prediction and that, at that time, the ART was not forecast to exceed the PTS screening criteria until sometime well after 40-years of service. In 1987 little thought was given to the possibility of license renewal, so there was then no motivation to prepare a surveillance program for a licensed lifetime beyond 40-years.

Concerning part (b) of your comment, the DCISC has expressed its perspective that Capsule B should be withdrawn and has urged PG&E to do so at the next outage. DCISC has also stated that further evaluation of the operating integrity of the Diablo Canyon Unit 1 reactor vessel should await the new information coming from Capsule B. PG&E has stated that the scheduled outage in 2025 will include withdrawal of the core barrel allowing easier access to the stuck specimen holder containing Capsule B. Also, given the available data from already withdrawn specimens, which provide data to a fluence exceeding that to which the reactor vessel has been exposed so far (see Figure 2 of {Part 2 Rpt}, the {Part 2 Rpt} shows that the embrittlement of the reactor vessel is acceptable for continued operation at least until Capsule B is withdrawn and tested, after which the plant's embrittlement will be re-assessed according to NRC requirements. The DCISC has publicly stated that it plans to review the results of the Capsule B data to ensure that embrittlement of the reactor vessel continues to be acceptable for extended operations, and the DCISC carries an item on its Open Items List to do so.

Also concerning part (b) of your comment,

Section 3.4.2.2 of the {Part 1 Rpt) states that the mini-CT technique for determining fracture toughness is a standardized method performed following the requirements of ASTM E1921 to determine a value of T_0. That section of the {Part 1 Rpt} also stated that there is regulatory precedent for using T_0 values determined in this way, but that case-by-case regulatory approval is needed for such applications via the NRC's exemption review process[2]. Your suggestion to machine mini-CTs from tested Charpy specimens, which are irradiated, is very costly because the machining process has to be performed remotely in a hot cell. If T_0 values were determined in this way from the previously tested samples originally in Capsules S, V, and Y, this would provide duplicate data at existing fluence values, not new data at different fluences.

Additionally:

(1) A PTS analysis using existing data from capsules S, V, and Y as well as the sister plant data already show acceptable margins relative to the NRC's PTS screening criteria,
(2) The quantity of data used in this assessment exceeds the NRC's requirements for Diablo Canyon Unit 1, and
(3) The existing data are available to a fluence well in excess of the 60-year fluence for Unit 1,

This conclusion is further supported by the Supplementary Analysis performed using the Draft ASME Code Case N-914 found in Section 4.1.2 of the {Part 2 Rpt}.

Thus, there is little motivation to do further testing on samples from Capsules S, V, and Y. V.

In **comment #5** of your letter of 18th July you state, in part, the following:

(a) The fact that there are no properly constituted Charpy samples in the remaining capsules in the RPV is particularly significant in light of the fact that staff and committee members are currently suggesting that Mini-CT testing is not "approved or endorsed" by the NRC when Dr. Kirk suggests it is and it is in fact the only method remaining in which to test the Capsule B weld-27204 samples.

(b) What is not shown in Kirk's graphs (beginning on page 28, Part 2 of the Kirk Report) of "adjusted RT-NDT" is that the projected RT-PTS has been consistently within 3-5% of the 10 CFR 50.61 screening limits in the Capsule S, V & Y Reports as well as in the 2006 recalculation to obtain a 37-month license extension through November 2024. Whereas the shift in RT-NDT of the samples may show a gradual rise in embrittlement tested over time, the projected embrittlement at end of life has consistently approached regulatory limits for DCPP-1 data.

(c) The regulations as stated in section 50.61 clearly state that all prior data and reports should be considered"; Dr. Kirk interprets this to mean all prior data should be integrated (using Equation 5 which inherently reduces both chemistry factors and margins).

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[2] Licensees are required to obtain "exemptions" from the NRC in instances when the NRC's rules are not or cannot be followed. Exemptions are common. The need to obtain an exemption does not indicate that anything is wrong, but rather that the NRC need to perform case-specific reviews in certain circumstances.

Part (a) of your comment is incorrect. Table 2 in {Part 2 Rpt} describes the samples loaded into all capsules. It shows that Capsule B contains the following samples of weld wire heat 27204:

- From Diablo Canyon Unit 1 Surveillance Weld
  - 2 WOL specimens that were irradiated to a fluence of 2.83×10^{18} n/cm^2 in Capsule S before being placed into Capsule B
  - 9 Charpy inserts that were irradiated to a fluence of 2.83×10^{18} n/cm^2 in Capsule S before being placed into Capsule B
- From what is described as a "surrogate weld" of weld wire heat 27204. This weld is identical to the Palisades "sister plant" weld[3]
  - 15 unirradiated full size Charpy specimens

15 full size Charpy specimens exist for the surrogate weld, which as stated is the same as the sister plant weld. Since the sister plant weld has already been accepted as sufficiently similar to the Diablo Canyon Unit 1 beltline welds, there is no reason not to also accept the data from the surrogate weld once it is tested.

The 9 "Charpy inserts" placed in Capsule B are the broken halves of weld metal samples of the original surveillance weld tested in Diablo Canyon Unit 1's first capsule, Capsule S. As stated in Section 2.1.1 of {Part 2 Rpt} as well as in the commentary headed "Page 8, Item V" of the {May '24 Ltr} the reconstitution procedures of [ASTM-E1253] can be used to restore these samples to full Charpy size before testing.

Thus, the samples of weld 27204 can be tested as Charpy V-notch samples. Mini-CT testing is not, as you state, "*the only method remaining in which to test the Capsule B weld-27204 samples*."

Finally, nowhere did Dr. Kirk state that mini-CT testing has been "approved or endorsed." In Section 3.4.2.2 of {Part 1 Rpt} Dr. Kirk stated that "*As described in [MRP-418] and [MRP- 462] there is both regulatory precedent and standard ASME procedures for using values of T_0 in RPV integrity assessment.*" The existence of precedent and standard ASME procedures does not imply endorsement by the NRC. Mini-CT tests could be performed, but to do so would require PG&E to obtain an exemption from the requirements of [10CFR50-AppH] from the NRC.

Part (b) of your comment is incorrect. Figure 3 in the {Part 2 Rpt} shows the various estimates of the ART curves throughout Unit 1's lifetime, the NRC's PTS screening criteria, and indicates the fluence values for the inner diameter of the Diablo Canyon Unit 1 RPV after both 40- and 60-years of operation. This figure clearly illustrates the proximity of the Unit 1 ART curves to the PTS screening criteria. The figure further shows that from the beginning of its operating life Unit 1 was expected to experience sufficient embrittlement to bring it into proximity with the NRC's PTS screening criteria.

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[3] The "surrogate" and "sister" welds both come from the same source. The unirradiated properties of this single weld are described in a report by B.C. Chang, "Fabrication of Charpy Specimens from Reactor Vessel Weld Archive Material for Electric Power Research Institute," ABB Combustion Engineering Nuclear Power, Windsor, Connecticut, Report ID TR-MCC-189, February 1992.

Part (c) of your comment is incorrect. Nowhere does [10CFR50.61] make any statement that "*all prior data and reports should be considered.*" Also, assuming that by Equation 5 you mean the NRC's process for adjusting ΔT_{41J} estimates in light of data which is described in Section 2.4.2.2 of the {Part 1 Rpt}, there is nothing inherent to this process that reduces the value of the chemistry factor or the margin term. If ΔT_{41J} values are measured that are either higher than expectations or exhibit more scatter than expectations, then both the chemistry factor and the margin can increase.

In **comment #6** of your letter of 18th July you state, in part, the following:

> *Because PG&E questioned the veracity of their prior capsule reports, and credibility has waffled (as it will) when investigating different subsets of data, additional retesting of the Capsule Y, S and V samples using Mini-CT methods as prescribed by Dr. Kirk (Part 2, page 40) is the only prudent decision the DCISC can make at this juncture.*

Page 40 of the {Part 2 Rpt} makes no statements about mini-CT specimens. That page discussed upper shelf energy analysis. Mini-CTs are too small to measure fracture toughness on the upper shelf of a reactor pressure vessel steel because the size requirements for J-R curve testing per ASTM E1820 can never be satisfied.

Nothing in the {Part 1 Rpt} and {Part 2 Rpt} suggested the use of Mini-CTs for J-R curve testing, which provides a measurement of fracture toughness on the upper shelf. Mini-CTs were, however, suggested as a possible alternative to obtain T_0 data. T_0 provides a measure of fracture toughness in transition. Because values of fracture toughness are lower in transition than on the upper shelf, smaller specimens such as the mini-CT can be used for this type of testing. In his statements Dr. Kirk does not "prescribe" mini-CT testing. Rather, Section 3.4.2.2 of the {Part 1 Rpt} contains the following statement: "*Should there be a need to perform additional testing on the Diablo Canyon Unit 1 beltline materials, techniques exist to directly estimate transition fracture toughness from small compact tension specimens that can be machined from the broken halves of the tested Charpy specimens. These small specimens are called "mini compact tension" specimens, or mini-CTs.*"

In **comment #7** of your letter of 18th July you state, in part, the following:

> (a) *If sister plant data cannot be integrated without accounting for plant operational differences, and Table 1* [of ASTM E185] *suggested that 5-capsules would have been required, that is all that is needed to justify additional CT testing at this time. There is NO REASON to wait for the removal of Capsule B.*
>
> (b) *In fact, the calculated fluence limit suggested by Dr. Kirk that Capsule B must be removed by 2028 suggests that after that time, fluence will be too high to meet regulatory requirements, and that test results after 3.7+19 has been reached will have greater uncertainty and may be invalid.*

Part (a) of your comment is incorrect. As described in response to your comment #3(a) (see above), Diablo Canyon Unit 1 is a 3-capsule plant, not a 5-capsule plant. It may also be noted that when the Palisades data are considered as part of the embrittlement evaluation, there are 5 capsules and the highest fluence of those data exceeds considerably a fluence Unit 1 will not reach until 60 years of operation.

Concerning your part (b) comment, it is correct to state that if Capsule B cannot be withdrawn in 2025 when the target fluence will be 3.7×10^{19} n/cm^2 it should be withdrawn before 2028 to stay below the recommended maximum fluence of no greater than 2-times the 60-year fluence, which is 4.02×10^{19} n/cm^2 for Unit 1. This guidance is stated in [ASTM E185-82] and in [NUREG-1801]. These statements are guidance only, not a hard cut-off. While it is desirable to obtain the Capsule B information as early as practicable, fluence values of 4.02×10^{19} n/cm^2 are common in both domestic and international experience; there would be no technical reasons to judge such data to be invalid.

In comment #8 of your letter of 18th July you state the following:

> *Because the DCPP-1 surveillance program was not modified to a 5-capsule program when the indication of embrittlement was first evident, there is not sufficient data to address the relative uncertainties that were calculated as part of the three Capsule Reports completed to date.*

Your comment that Diablo Canyon Unit 1 should have 5 surveillance capsules during its first 40-year licensing term is incorrect. Please see the detailed discussion of this point in our reply to your comment #3(a), above.

Your statement that there are insufficient data from which to assess uncertainties is also incorrect. These uncertainties are not assessed on a plant-by-plant basis but rather via the NRC's Margin term (see equation (3-1) in {Part 2 Rpt}, including defined values for σ_U and σ_Δ). The NRC's Margin term was based on a large collection of data from the operating fleet. This approach ensures that uncertainties are appropriately bounded even at times early in plant life before any surveillance data are available.

In comment #9 of your letter of 18th July you state, in part, the following:

> (a) *There are not 100 plants that have "similar" weld material in the US that would give us a much larger pool of data pertaining to the severe embrittlement that has been measured at DCPP-1 and Palisades (PNP), as Dr. Kadak suggested that Dr. Kirk's work has referenced.*
>
> (b) *A larger pool of data pertaining to chemically similar or identical material would significantly reduce the uncertainty ranges that currently lead to my discomfort with the current analysis. To my knowledge the only such nationwide analysis was the NRC's 1987 analysis of plants nationwide in which they applied the new procedures defined in RG1.99 Rev. 2, (subsequently published in 1988), Palisades and Diablo Canyon stood out as more negatively affected by the new NRC procedures than other plants in the US, a point which Dr. Macdonald attempted to highlight in his presentation, but which was immediately discredited as a misrepresentation by Dr. Kadak.*

It appears that the origin of your part (a) comment, is a statement made by Dr. Kadak at time 06:15:18 during the 20th June 2024 public meeting. In his remarks Dr. Kadak referred to "*hundreds of data points from other reactors that have similar welds*" used by Dr. Kirk in his supplemental analysis (see Section 4 of {Part 2 Rpt}), not to hundreds of plants that have similar weld material, as you have stated. Dr. Kadak's statement was made extemporaneously and from memory. His point

would have been made more clearly by his stating that there was a large international database from which to validate embrittlement trend performance, as illustrated by both Figure 12 and Figure 18 of the {Part 1 Rpt}. It may also be noted that Figure 8 of the {Part 2 Rpt} shows that similar welds to those in Diablo Canyon were found in Palisades and in three PWRs in Germany, for a total of 11 measurements.

Concerning your part (b) comment, the DCISC's objections to Dr. Macdonald's use of a value from the NRC document you cite (see ADAMS ML102310298) occurred because the value he took from this NRC document was a prediction of ΔT_{41J}, it was not a measured value from either Diablo Canyon or its sister plant. He used this predicted value along with measured values of ΔT_{41J} from surveillance testing to perform a PTS assessment. Such mixed use of predicted and measured values is not appropriate in a PTS assessment; we have made this point to Dr. Macdonald in a separate letter. Also, for your information the NRC also performed such a nationwide analysis in one of their reports that formed the technical basis for the alternate PTS rule (see Tables 3.3 and 3.4 in NUREG-1874, https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1874/index.html).

Your **comment #10** addresses your concerns regarding the DCISC's treatment of Dr. Macdonald and his comments during the DCISC public meeting of 20th June 2024. This Δcomment contains no technical concerns and so is not addressed here.

Your **comment #11** summarizes the various concerns you raised in comments #1-#9 and so is not addressed here.

In closing, we would like to offer the following additional general comments:

1. The video tape of the June 20th, 2024 meeting contains no statements that you supported the immediate shutdown of Unit 1.

2. A review of the video tape from the 20th June meeting shows that the "cardinal sin" comment was first made by Dr. Macdonald, who accused Dr. Kirk of committing one when he did not include error bars on his figures showing ΔT_{41J} as a function of fluence. Dr. Macdonald was subsequently challenged by Dr. Budnitz for incorrectly calculating the errors bars on his plot (his Figure 1) therefore committing the same cardinal sin. Error bars were not used by Dr. Kirk in his plots because the ART curves include the Margin term, which accounts quantitatively for the errors. While this was an unfortunate exchange, you have incorrectly characterized the facts in your letter to the DCISC.

3. The DCISC has given you considerable time in public meetings to express your views. You have provided considerable information to review and your comments are appreciated. We hope that the information in this letter succeeds in closing whatever gaps remain in our mutual understanding.

We thank you for your comments and continued concern regarding the operating safety of the Diablo Canyon Nuclear Power Plant. We hope the information presented this letter helps to address your concerns.

Now, stepping back to look at the big picture of the issue of DCPP Unit 1 reactor vessel embrittlement, please consider the following:

1. As detailed in [DCL-23-038], PG&E's knowledgeable technical experts on embrittlement have concluded that the DCPP Unit 1 reactor vessel embrittlement is acceptable not just for 40 years but for 60 years. This assessment is currently under review by the NRC.

2. As detailed in the {Part 2 Rpt}, the DCISC's knowledgeable technical expert on embrittlement has concluded that the DCPP Unit 1 reactor vessel is acceptable not just for 40 years but for 60 years.

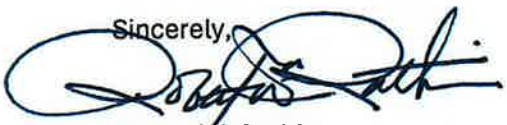
3. Whereas the DCISC does recommend the removal and testing of Unit 1 Capsule B, all currently available information suggests the acceptability of Unit 1 to 60 years and beyond. Our assessment of acceptability will be re-visited once data from Capsule B becomes available.

Based on the above, the {Part 2 Rpt} shows that based on all information now available, that Unit 1's fracture toughness after embrittlement is acceptable for not just 40-years but for 60-years. Currently there is no evidence that technically challenges this conclusion. This position will be re-evaluated once data from Capsule B becomes available.

The foregoing responses were prepared by DCISC technical consultants and circulated individually to the Committee Members in accordance with established DCISC protocol. In accordance with past practice a copy of this letter with its appendix will subsequently be posted on the Committee's website at www.dcisc.org. A discussion regarding integrity of the Unit 1 reactor pressure vessel will be on the agenda for the October 9-10, 2024, public meeting to be held in Avila Beach, California. Any questions may be addressed to the undersigned at info@dcisc.org.

On behalf of the Committee, thank you for your additional comments and input into our deliberations.

Sincerely,



Robert W. Rathie
DCISC Assistant Legal Counsel

Appendix

APPENDIX

LETTER TO DCISC FROM MR. G. BRUCE SEVERANCE OF JULY 18, 2024

Comments to the DCISC Addressing Misrepresentations by Staff at the June 20th Presentation and How NRC Procedure Has Been Violated by PG&E and Westinghouse.

Please note my positions on embrittlement were misrepresented in your slides and they differ substantially from those of Mothers For Peace and their Expert Dr. Macdonald

July 18, 2024 Comments by Bruce Severance
Regulatory Compliance Engineer, Member of the DCDEP (acting individually)

Distinguished Members of the DCISC and Staff,

I must admit that after dedicating a significant amount of time on a voluntary basis over the past two years to reading over 4000 pages of correspondence and reports pertaining to Unit 1 embrittlement, I was frustrated to have your staff misrepresent my position on the facts, my concerns about the data and falsely represent that I misunderstood data credibility as it is used in the literature, and therefore I "misunderstood NRC procedure". To have the entire body of my 100+ pages of analysis submitted over the past two years discredited in this way was remarkable. Dr. Kadak's presentation slides also suggested that Dr. MacDonald and I agreed that NRC mathematical procedures were questionable, and I do not and have never taken that position. I have always felt there are substantive reasons for calling for more testing of the S, Y and V samples using alternative test methods given the inadequacy of the current data sets and the questionable deviation from NRC procedures used to integrate the DCPP-1 and Palisades data. However, I did not suggest NRC equations were inadequate, or support alternative mathematical procedures which was solely Dr. Macdonald's endeavor and one that merits review however unorthodox you may consider it to be. He does address anomalies that arise from the standard NRC procedures about which I had not been previously aware.

During my June 20th public comment, I made the rather pointed remark that some committee members and staff were "gaslighting", that is to say presenting the opposite conclusion than what is clearly stated in the regulations, but I was given insufficient time to explain this remark or defend its veracity, and factual evidence to support it. I do not use the "gaslighting" accusation lightly and it merits justification. I also was not given time to defend the key elements of my prior research and I will try to minimize undue repetition as Dr. Budnitz has requested. I should point out that many remarks by Digby Macdonald (correct spelling) and myself are in agreement and others are not. I do not and have never called for the immediate shutdown of Unit 1 pending further study, as Dr. Macdonald has suggested.

My further comments are summarized as follows:

1) The interpretation that Dr. Kirk and now Dr. Kadak's assert, that "sister data is required to be integrated using Equation 5" is not substantiated and appears nowhere in the NRC regulations. Dr. Kirk claims an exemption for integration of "sister plant data" that is contrary to the integrated surveillance program (ISP) criteria as defined by 10 CFR 50, Appendix H. It is argued by your staff that Palisades and DCPP-1 are not participants in an ISP program and that they are exempt from Appendix H requirements, that the similarity of plant design, and operating conditions such as fuel configuration, operation at partial power and the use of shielding to

reduce neutron bombardment need not be considered. Nothing in the regulations actually states this. It is gaslighting to suggest that NRC procedures requires "integration of sister plant data" as Dr. Kirk has asserted, when the term "sister plant" is not even defined in the regulations. Equation 5 suggests a method to integrate data from two different plants provided they have similar design, similar operating conditions and chemically similar limiting materials. The mathematical procedure used in the Westinghouse Report is referred to as an "integration", yet you claim exemption from all of the requirements for "integrated surveillance programs" (ISP). This is regulatory "double-speak". Dr. Macdonald's 60-page report goes into some detail regarding why the Palisades data doesn't meet the Appendix H ISP-participating criteria. Dr. Kadak's comment that Diablo Canyon doesn't currently participate in an ISP program and therefore this qualification doesn't apply is inherently a false in its premise. Westinghouse employs a mathematical integration procedure without meeting the criteria in order to use this procedure. Dr. Kadak referred in his comments to a citation presumably from Kirk's report or written comments that integration of "sister plant" data is allowed or required, but didn't reference the specific NRC regulations that allow such integration. I believe this is a clear misrepresentation of NRC regulations. I would ask Dr. Kadak to show definitively where in the regulations it is stated that "sister plant" data must be "integrated" without determining plant design and chemistry similarity.

2) Dr. Macdonald is correct to question how the sister plant data is integrated and whether all variables are "captured" by the temperature adjustment equations as Dr. Kirk suggests. Clearly, the operating conditions and design are vastly different, and temperature adjustment equations would not capture variables such as the use of neutron bombardment shielding in the Palisades fuel racks that could significantly alter the neutron bombardment experienced by the most vulnerable section of the axial welds at Palisades. It is gaslighting to smooth over such concerns and a rather unjust assertion to brush this concern off as a "misunderstanding of NRC procedures". I do not believe that Dr. Macdonald deserved the rather rude impalement of very well-articulated arguments that merit closer examination.
3) It is gaslighting to suggest as one committee member did, that further clarification or data are needed to "bolster" the argument for requiring further retesting of archived surveillance capsule samples using the Mini-CT methodology as Dr. Macdonald suggests. It is abundantly clear that ASTM E185-70 Table 1 required an amendment to a 5-capsule program by 1987. Because of the very early detection of a rapid embrittlement trajectory, the regulations did in fact require more data which PG&E, the NRC and now the DCISC have denied. This is an instance in which the regulations are abundantly clear and in "black and white", and yet DCISC staff feels empowered to deny what is obviously true and refute or contest Dr. Macdonald's insights without close examination. The exposure to liability and blame should something go wrong is palpable if in fact the interpretations of the regulations are at odds with facts. Dr. Budnitz's position is to simply state that in absence of further data you wish to proceed with endorsement of the Kirk Reports without acknowledging that the regulations clearly state that integration of data between to ISP-participating plants cannot substitute for or reduce the required surveillance testing (1995 Update to 10 CFR 50, Appendix H, Federal Register, Dec. 19, 1995, Vol.60, #243, pg. 65476).

4) Dr. Macdonald clearly stated, and correctly cited the NRC regulations when he suggested that Table 1 of ASTM E185-70 requires a 5-capsule program if it is found in early capsule tests that an RPV is on a trajectory that indicates an RT-NDT delta exceeding 200F. Dr. Kadak was gaslighting when he asserted that Table 1 doesn't state that. It is clearly shown in Table 1 that an RPV headed for greater than 200F difference in RT-NDT (aka "shift") must be amended to a 5-capsule program. The fact that this NRC procedure was not followed in 1987 is consequential. Although Diablo Canyon was initially approved for a 3-capsule surveillance program in its original license, the results of the 1987 Capsule S results SHOULD have triggered an amendment to the surveillance program and additional capsules containing the most limiting weld material (heat#27204) SHOULD have been added at that time. Dr. Macdonald correctly pointed out that it is interesting and telling that this NRC protocol was not followed in 1987. By the time that PG&E decided to add additional 27204 weld material to the capsules in 1992, when the Capsule Y test was withdrawn for testing, there was no #27204 weld material available from the original manufacturer with which to machine properly constituted Charpy test samples. PG&E had to make do with reinserting previously fractured Capsule S samples that can only be tested using alternative means (Mini-CT or Nano-indentation). Now the DCISC committee is both asserting that we should wait for the Capsule B tests to make further assessment, and they argue that the Mini-CT testing is invalid or unacceptable for retesting of the Capsule S, V & Y samples already in hand. If it is invalid for one test why is it valid for another? You can't have it both ways. Because of PG&E's negligence and failure to follow Table 1 requirements in 1987, WE ARE IN A SITUATION IN WHICH WE HAVE INSUFFICIENT DATA TO MEET REGULATORY REQUIREMENTS, and it is clear from the regulations that "integration" of data from a "sister plant" cannot be allowed to serve as a substitute.
5) The fact that there are no properly constituted Charpy samples in the remaining capsules in the RPV is particularly significant in light of the fact that staff and committee members are currently suggesting that Mini-CT testing is not "approved or endorsed" by the NRC when Dr. Kirk suggests it is and it is in fact the only method remaining in which to test the Capsule B weld-27204 samples. Furthermore, if Dr. Budnitz is suggesting that we need further evidence to "bolster" the argument that Mini-CT testing of the archived samples will yield the desired reliable data, one need only turn to the history of embrittlement of Unit 1. What is not shown in Kirk's graphs (beginning on page 28, Part 2 of the Kirk Report) of "adjusted RT-NDT" is that the projected RT-PTS has been consistently within 3-5% of the 10 CFR 50.61 screening limits in the Capsule S, V & Y Reports as well as in the 2006 recalculation to obtain a 37-month license extension through November 2024. Whereas the shift in RT-NDT of the samples may show a gradual rise in embrittlement tested over time, the projected embrittlement at end of life has consistently approached regulatory limits for DCPP-1 data. Kirk avoids this pointing out this truth throughout his 160+ pages of reports, a fact which by itself should cause the DCISC committee to question his endorsement of the license extension. This is not new to you. I have stated this fact many times, but you drank Dr. Kirk's Koolaid when he stated that the new "integration of sister plant data supersedes all prior reports". The regulations as stated in section 50.61 clearly state that all prior data and reports should be considered"; Dr. Kirk interprets this to mean all prior data should be integrated (using Equation 5 which inherently

reduces both chemistry factors and margins). Why would the regulations require an integration process that automatically reduces margins of error regardless of how badly embrittled the prior data indicated the RPVs to be? The entire premise is contrary to logic. In effect this position states: "If your RPV looks severely embrittled use this formula to reduce margins of safety and to make your data look better". Really? Is that the logic the committee intends to adopt without verifying for yourselves what the regulations state to the contrary?

6) Because PG&E questioned the veracity of their prior capsule reports, and credibility has waffled (as it will) when investigating different subsets of data, additional retesting of the Capsule Y, S and V samples using Mini-CT methods as prescribed by Dr. Kirk (Part 2, page 40) is the only prudent decision the DCISC can make at this juncture. Notice: I am not calling for shutting down the reactor; only asking that since the Mini-CT method is the only means remaining due to PG&E's failure to add more 27204 samples in 1987, we should pay the for additional retesting which will only cost 1/1000 of the state's proposed budget for extended operation. This is PRUDENT from a financial as well as safety perspective, as it will minimize the financial risk of stranded assets. There IS NO CLEAR ARGUMENT AGAINST PRUDENCE OF THIS KIND. Given the cost, retesting of the existing Capsule S, Y and V samples should be a given. No further argument is needed to "bolster" such a prudent investment. The suggestion that the uncertainties are so well understood that such an investment is not prudent is another form of gaslighting. Dr. Budnitz is overstating his confidence that the Kirk Report should be endorsed because he has not investigated in sufficient detail the fact that NRC procedures have not been followed at several junctures.
7) If sister plant data cannot be integrated without accounting for plant operational differences, and Table 1 suggested that 5-capsules would have been required, that is all that is needed to justify additional CT testing at this time. There is NO REASON to wait for the removal of Capsule B. In fact, the calculated fluence limit suggested by Dr. Kirk that Capsule B must be removed by 2028 suggests that after that time, fluence will be too high to meet regulatory requirements, and that test results after 3.7+19 has been reached will have greater uncertainty and may be invalid. The sooner that Capsule B is removed the better. The fact that the DCISC is in fact entirely dependent upon Mini-CT testing when Capsule B is extracted is in fact a clear argument against invalidating the request for Mini-CT testing of Capsule S, Y and V within the coming months. To suggest that retesting of these samples is not justified because Mini-CT testing is questionable or invalid, is therefore another form of gaslighting.
8) Because the DCPP-1 surveillance program was not modified to a 5-capsule program when the indication of embrittlement was first evident, there is not sufficient data to address the relative uncertainties that were calculated as part of the three Capsule Reports completed to date.
9) There are not 100 plants that have "similar" weld material in the US that would give us a much larger pool of data pertaining to the severe embrittlement that has been measured at DCPP-1 and Palisades (PNP), as Dr. Kadak suggested that Dr. Kirk's work has referenced. A larger pool of data pertaining to chemically similar or identical material would significantly reduce the uncertainty ranges that currently lead to my discomfort with the current analysis. To my knowledge the only such nationwide analysis was the NRC's 1987 analysis of plants nationwide in which they applied the new procedures defined in RG1.99 Rev. 2, (subsequently published in

1988), Palisades and Diablo Canyon stood out as more negatively affected by the new NRC procedures than other plants in the US, a point which Dr. Macdonald attempted to highlight in his presentation, but which was immediately discredited as a misrepresentation by Dr. Kadak. In fact, Palisades and DCPP-1 have been recognized as among the 4 most embrittled plants that have not been decommissioned in the US fleet. The assertion that data cited from this 1987 study is a misrepresentation of fact could be called "gaslighting". The suggestion that there are other plants still in service that employ the 27204 weld material is false. All the other plants using this material are out of service, including Palisades which may be restarted, a highly questionable proposal. Your staff insists on looking at hard data, but when the data do not conform to your pre-determined conclusions you immediately seek to discredit a very expert witness who is raising key facts.

10) I cannot defend Dr. Macdonald's error in applying a generic error bar from the Eason-Odette study, as it is clear that it shows negative values where they should not exist, and he apologized and admitted his error. I also do not agree that the plant needs to be immediately shut down. However, it is offensive to Dr. Macdonald and unreasonable to throw out his expert opinion on the basis of this relatively minor oversight in his application of well-documented error bars that were substantiated by the Eason-Odette research that was fully endorsed by the NRC. Dr. Macdonald was humble enough to say he would correct the error bar in question, and yet he was accused of committing a "cardinal sin" and he was told that if he corrected it his opinion may be considered. It appears to me that members of the committee had predetermined conclusions and were in search of any mechanism by which they could justify invalidation of Dr. Macdonald's report, opinions and his distinguished career. He is a Nobel and Fermi Award Nominee, and anything but "a one-trick pony" as suggested by one comment. I doubt that the committee had read his report at the time of the June 20 meeting given its late submittal, and I can only hope that the committee remains open to reading his report now. Certainly, it should be read with an open mind before moving to endorse the Kirk report and "greenlighting" an additional 20-year extension without fully vetting and verifying whether NRC procedure was followed correctly in order to derive more favorable projections.

11) There is no invalidation of what is not opinion and what appears to be fact: NRC regs would have called for modification to a 5-capsule program by 1987, DCPP-1 and Palisades were both recognized to be severely embrittled or trending toward severe embrittlement by EOL at that time, and there is little justification for integrating data from the two most embrittled plants in the US to yield results that are so favorable they far exceed all prior capsule report projections and far exceed all prior uncertainty ranges. The automatic "integration" of DCPP-1 and PNP data sets as assumed to be correct by Westinghouse and Dr. Kirk, results in an automatic reduction in both the CF values as well as margin (M) as admitted by Dr. Kirk in conversation. How can one justify reduction of these variables without meeting the Appendix H criteria for doing so? Dr. Macdonald is correct for questioning HOW the 2011 Westinghouse justifies integration of "sister plant data" without compliance with Appendix H and without fully explaining the rationale for an "exemption" simply because they are "sister plants" when no such exemptions are granted by the regulations.

In conclusion, there are substantial reasons to question procedure given the apparent deviation from NRC procedures, the failure to amend the surveillance program in 1987, the lack of properly constituted Charpy samples in Capsule B, PG&E's invalidation of all pre-2003 data (all data to date) in 2003, the subsequent application for a 37-month extension in which PG&E and NRC calculated that DCPP-1 would be within 3% of 50.61 screening limits by end of 2024, and the degree of shift in the data as presented in the 2011 Westinghouse report which far exceeds prior uncertainty ranges. Any normally prudent person, especially those with distinguished scholarly backgrounds would recognize the value of having additional data which can be readily afforded. WE ONLY NEED TO SPEND 1/1000TH OF THE STATE BUDGET FOR EXTENDED OPERATION TO PERFORM ADDITIONAL TESTING. The normally prudent person would invest in having this additional data given the uncertainties that continue to swirl around the Westinghouse methodology as endorsed by Dr. Kirk. Kirk's independent evaluation indicates that Mini-CT is well accepted and that retesting before 2029 would be prudent, so how do we argue against the Mini-CT methodology in one instance and endorse it for testing Capsule B? Continued operation is inescapably dependent on Mini-CT testing rather than Charpy testing because of PG&E's failure to comply with the 5-capsule requirement in 1987. They saved millions due to that oversight and now it is time to invest in more data, a price they and the DCISC should be willing to pay for public safety and reduced financial risk to the State.

It is my hope that the committee doesn't simply write off the above concerns as my "misunderstanding of NRC procedure" as both Dr. Kirk and Dr. Kadak have suggested regarding my comments. I can say with confidence that virtually everything that Dr. Kadak said in his representations regarding my reports and misunderstandings were misstatements of my position and overlooked very valid points that I have made about NRC procedure which Dr. Macdonald has largely supported. It would be a grave error to continue on the trajectory to endorse the Kirk Reports which so clearly misstate and misinterpret both NRC procedure as well as the consistently severe embrittlement projected by 2024 at DCPP-1. The "new integration" of data from PNP is highly questionable because the mathematical results fall so far outside all prior uncertainty ranges due to the assumed ability to reduce chemistry factors and margins, which were conservatisms built into the calculations that are specifically most applicable to the two most embrittled RPVs in the US. Much is at stake if you fail as a committee to act with prudence and demand more data. As I said at the June 20th meeting in my public comments, I would be happy to see DCPP-1 run for another 20 years should additional data confirm it is safe to operate. In the absence of this testing, the committee is engaging in a dangerous misrepresentation of the certainty they have in the 2011 Westinghouse conclusions and Dr. Kirk's endorsement of them.

I do not feel anything in my analysis is exaggerated or a misinterpretation of fact. I am only calling for prudence, investment in further testing and consistency in how we evaluate compliance with NRC procedure and the regulations. I am not inherently anti-nuclear and do not align with anti-nuclear activists although I respect them as much as I do PG&E and DCISC staff. Please endorse further Mini-CT testing prior to endorsing the Westinghouse or Kirk Reports. To

me it is clear there is sufficient uncertainty to warrant further testing. I welcome phone calls and discussion.

Sincerely,
Bruce Severance
Regulatory Compliance Engineer
Energy Policy Analyst
Member of the DCDEP, (acting individually)