To: DCISC Members: September 22, 2025
Dr. Per F. Peterson
Dr. Najmedin Meshkati
Dr. Raluca Scarlat

From: DCISC Seismic Review Team:
Dr. Thomas H. Jordan
Dr. Michael E. Oskin
Dr. Scott T. Marshall

Re: SRT comments on 06/26/2025 letter to DCISC by San Luis Obispo Mothers for Peace

---

Dr. Peter Bird, in his role as a technical advisor to San Luis Obispo Mothers for Peace (SLOMFP), has argued in a series of filings to the Diablo Canyon Independent Safety Committee (DCISC) and the Nuclear Regulatory Commission that the seismic hazard from one or more thrust faults beneath the Diablo Canyon Power Plant (DCPP) has been underestimated by the Pacific Gas and Electric Company (PG&E). His critique is summarized in a report submitted to the DCISC on October 30, 2024 (Bird, 2024).

In February 2025, the Seismic Review Team (SRT) was charged by the DCISC to assess Bird's arguments, and we delivered a 98-page *Review of the Bird Critique* on May 30, 2025 (SRT, 2025a). Dr. Bird submitted a 13-page technical response to the SRT report on June 6, 2025 (Bird, 2025). Both the SRT report and Bird's response were presented at the DCISC public meeting on June 10, 2025. At the DCISC's request, the SRT provided a 30-page review of the Bird's response on August 16, 2025 (SRT, 2025b). Both SRT reports can be accessed via the DCISC website.

Dr. Bird and Diane Curran, Counsel to SLOMFP, submitted a letter on June 26, 2025, to the DCISC commenting on the June 10th meeting and requesting action on the Bird critique. The DCISC has asked the SRT to evaluate the scientific issues and technical arguments contained in the SLOMFP letter, and this memorandum summarizes our evaluation of its contents.

SRT commentary on 06/26/2025 SLOMFP letter.

The analysis of the Bird response follows the same format used in the two SRT reports. The verbatim text of the SLOMFP letter is reproduced in **blue font**, and the SRT's point-by-point comments are written below in **black font**. Many of the points in the SLOMFP letter are recapitulations of the technical arguments from Dr. Bird's earlier filings. In those cases, we refer to the sections in the two SRT reports where those arguments have been scrutinized and evaluated in detail.

June 26, 2025
Dr. Per F. Peterson
Dr. Robert J. Budnitz
Dr. Najmedin Meshkati
Diablo Canyon Independent Safety Committee California Public Utilities Commission
By email to Robert Rathie, info@dcisc.org

Re: *Follow-up to June 10, 2025 DCISC Meeting*

Dear members of the Diablo Canyon Independent Safety Committee:

We are writing to follow up on the DCISC meeting on June 10, 2025. As you will recall, during the meeting, Dr. Tom Jordan of the Seismic Review Team (SRT) acknowledged that an active thrust fault lies directly beneath the Diablo Canyon nuclear plant (DCPP). However, Dr. Jordan also said that it is "not new information," and downplayed its significance.

We respectfully submit that in two significant respects, Pacific Gas & Electric Co. (PG&E) has not done the type of studies that would be necessary for the level of confidence expressed by Dr. Jordan in PG&E's assessment of the threat posed by active faulting beneath the plant.

SRT comments: Dr. Jordan has made no statement to the DCISC nor to the public expressing confidence or lack of confidence in the PG&E SSC model. The SRT was not charged by the DCISC to conduct a technical review of the PG&E model, and we have not attempted to do so. Without a system-level technical review that explores the model's epistemic uncertainties and the implied hazard tradeoffs, the SRT cannot assign confidence levels to the model, its components, or the forecasted hazards. The SRT's recommendations for improving the SSC indicate that some features of the PG&E model may be suboptimal, but the degree to which the implementation of these recommendations will modify the hazard estimates remains to be demonstrated.

First, while PG&E claims to have modeled the fault in 2015, that is only a half-truth. PG&E did include a model where the San Luis Bay thrust extends West to the Hosgri fault, with a dip toward DCPP. However, the model suffered from four significant defects:

- PG&E kept the model fault trace as far as possible from DCPP so as to minimize the hazard. In contrast, Dr. Bird located his proposed Inferred Coastline thrust fault more realistically close to the plant.

SRT comments: At issue is the geometry of the Southwest Boundary Zone (SWBZ), which represents a zone of downward tilting and reverse faulting, about 2-km wide, that accommodates the shortening and uplift of the Irish Hills and San Luis Range. The SWBZ includes the San Luis Bay fault, Rattlesnake fault, and Olson Hill fault in the west, closest to the DCPP, and the Wilmar Avenue fault, Los Berros fault, and Oceano fault in the east, offshore of Pismo Beach. Two candidate models of SWBZ faulting beneath the Irish Hills are Bird's Inferred Coastline Thrust (Bird, 2024, fig. 3) and the San Luis Bay reverse fault in the SSC Southwest-Vergent fault geometry model (PG&E, 2024, fig.6-3). The model trace of the San Luis Bay fault lies approximately 2 km south of the proposed trace of the Inferred Coastline Thrust, but both fall

within the SWBZ. Neither hypothesized trace has been directly observed; hence, the available evidence does not show that the latter is more realistic than the former.

The statement, "PG&E kept the model fault trace as far as possible from DCPP so as to minimize the hazard," implies that shifting the fault trace closer to DCPP by a couple of kilometers would substantially increase the hazard. Observations and models of the hazard for sites on the hanging walls of thrust faults show little systematic variation on a 2-km length scale. In many models of high-frequency (5 Hz) spectral acceleration, reducing the site-to-trace distance actually decreases the hazard because it exposes the site to less of the fault area (e.g., Donahue & Abrahamson, 2014, fig. 6). We conclude that the differences in the trace locations of the Bird and PG&E candidate models do not imply significant hazard differences.

- PG&E assumed an unreasonably steep dip of 40°~80° for the fault, which both reduces its "potency" (proportional to seismic moment production rate), and also keeps it as far away from DCPP at depth as possible.

SRT comments: We agree that the best estimate of the SWBZ dip is on the lower side of the range considered by PG&E. Finding 14 of SRT (2025a) states: "The observed dip of SWBZ faulting ranges between 25° and 56° with a mean dip of 38º ± 3º, which is below the dip range allowed by the SW-Vergent FGM (45º-50º)." The fault-dip data are discussed in §3.3.1 of SRT (2025a) and §5 of SRT (2025b). The SRT has recommended that PG&E assess the hazard change due to the revised SWBZ dip.

- As is typical of PG&E's seismic models, PG&E used a very low slip-rate (0.08~0.20 mm/year) for the fault, both due to the assumed steep dip and because PG&E ignored the isostatic factor of 6 caused by the footwall sinking 5 m for every 1 m that the Irish Hills rise.

SRT comments: The PG&E SSC includes three fault geometry models (FGMs): Southwest-Vergent (SW), Outward-Vergent (OV), and Northeast-Vergent (NE), with logic-tree weights of 40%, 40%, and 20%, respectively. Only the SW FGM contains a SWBZ reverse fault that projects beneath the DPCC. PG&E identifies this component of the SWBZ as the BW section of the San Luis Bay fault. Four of the ten rupture sources in the SW FGM involve failure of the BW section. Summing the slip rates assigned to these four ruptures yields a total slip rate of 0.22 ± 0.08 mm/yr for the San Luis Bay fault (PG&E, 2015, tables 9-13 & 9-14).

In comparison, the slip rate of the San Luis Bay fault inferred from the terrace uplift rate (0.18 ± 0.3 mm/yr) and fault dip (38º ± 3º) is 0.29 ± 0.07 mm/yr (SRT, 2025a). Owing to the lower dip angle, the SRT estimate is higher than the PG&E SSC mean rate, but the difference is not statistically significant ($p = 0.18$). The SRT estimate is about an order of magnitude smaller than the rate values of 2.0-2.8 mm/yr proposed by Dr. Bird. The latter range is incompatible with the available geologic and geodetic data (SRT, 2025a).

The claim that the footwall is sinking five times faster than the Irish Hills are rising is an incorrect inference stemming from Dr. Bird's misapplication of the Airy isostatic compensation mechanism. Conclusive arguments for why the Airy mechanism does not apply to crustal loads as small as the Irish Hills are given in §3.1 of SRT (2025a).

- PG&E only considered models in which the San Luis Bay fault dips under DCPP in their southwest-vergent model set (with overall logic weight of 40%). Then, this weight was subdivided among at least 4 models, of which only one has the San Luis Bay fault extending to the Hosgri fault as a pure thrust with uninterrupted ruptures. Thus, the weight PG&E applied to this most realistic model was no more than 10%. This composite hazard minimizes the significance of any individual fault – and of course, the individual fault directly beneath the plant should be a matter of serious concern. There should have been a sensitivity study in which this fault geometry was assigned 100% weight.

SRT comments: The first sentence is correct, but the second and third are not (see discussion above). The SRT agrees that more weight should be assigned to the SW FGM. In its recommendations, the SRT states, "PG&E should specifically reexamine the weighting of alternative FGMs, and it should assess the impact of placing significantly more weight on and lowering the dip range of the SW-Vergent model, which better represents the likely reverse-fault hazard."

In its 2015 report, PG&E did in fact do the sensitivity test that assigns full weight (100%) to the SW FGM. PG&E (2015, p. 14-5) describes the results as follows: "At the 5 Hz spectral frequency (Figures 14-6a and b), the different FGMs correspond to noticeable differences in hazard, with the OV Model resulting in ground motion ratios slightly less than unity, the SW Model yielding ground-motion ratios near unity, and the NE Model yielding ground-motion ratios slightly greater than unity." According to this sensitivity analysis, 100% weighting of the SW FGM in its current form would make a negligible change to the DPCC hazard.

Second, as also mentioned by Dr. Jordan, PG&E has made no new assessment of the capability of the fault (e.g., taking into account the new peak ground acceleration (PGA) values observed in the 1 January 2024 Noto Peninsula earthquake).

SRT comments: In his response of June 6, 2025, Dr. Bird agrees with the SRT conclusion that the 2024 Noto Peninsula earthquake (Noto24) fails as an analog for thrust faulting beneath the Irish Hills because the great length of the rupture (~150 km) cannot be accommodated by the SWBZ or any other reverse fault system involving the San Luis-Pismo block. Given this incompatibility, he proposes to cut the Noto24 rupture in half and to use only the southwestern part of the rupture as the analog event. As discussed by the SRT (2025b, p. 21), this ad hoc editing procedure is seismologically unacceptable, and it violates the basic rationale for using a natural earthquake as an analog event in the hazard analysis.

Thus, PG&E's claim to have evaluated the active thrust fault beneath DCPP is seriously misleading, and Dr. Jordan's expression of confidence in PG&E's work is unfounded.[1]

SRT comments: As noted above, neither Dr. Jordan nor other members of the SRT have made statements to the DCISC or to the public expressing confidence or lack of confidence in the PG&E SSC model.

It is our understanding that by "accepting" the SRT's report, you have not made formal findings regarding the seismic risk posed by extended operation. Therefore, we urge you to consider the following:

Dr. Bird continues to stand by his expert opinion that continued operation of DCPP poses an unacceptable seismic risk. The SRT's objection to the isostatic model for thrust slip rates confuses Bouguer with isostatic gravity concepts and uses the wrong physical model of the lithosphere. The SRT's objection to the method using the throw rate of map unit Tmo to estimate thrust slip rate was illogical because their interpretation only converts that rate into a lower limit; it does not dismiss it. And the SRT's analysis of GPS data was needlessly complex, causing the obvious horizontal shortening across the Irish Hills to be averaged together with different tectonics in adjacent ranges. Finally, the SRT's dismissal of the Noto Peninsula earthquake as an important analog because it had unusually high PGA should not stand among SSHAC experts who understand the importance of exceptional events.

SRT comments: We stand by our assessments of the Bird critique contained in our two reports. Dr. Bird's (2025) specific objections to the SRT (2025a) analysis, described in the above paragraph, have been addressed in our review of his response (SRT, 2025b). We conclude (p. 25): "Dr. Bird's response to the SRT report has not dispelled our objections to his estimates of the DCPP thrust-faulting hazard. We have carefully reviewed his response but found no new observations or theoretical considerations that would justify changing our overall assessment. The main assertions of the Bird critique are not supported by the scientific evidence and should be discounted as arguments for high thrust-fault hazard at DCPP."

Dr. Bird also continues to stand by his recommendations, which are found on page 10 of his June 6, 2025 technical report to you. These recommendations should be taken up immediately.

SRT comments: As noted in SRT (2025b), Dr. Bird's recommendations (i)-(iii) on p.10 of his response overlap with the SRT recommendations regarding fault-system and geodetic modeling,

[1] Nor, as observed during your meeting by John Geesman, counsel to Alliance for Nuclear Responsibility (A4NR), has PG&E submitted the deterministic study of a San Simeon-like earthquake beneath DCPP that was requested by the California Energy Commission 17 years ago. Instead, during your June 10 meeting and in written correspondence, PG&E has falsely asserted that this deterministic study has been done and is documented in the 2011 Shoreline Fault Zone report. As Mr. Geesman stated during the meeting and in formal correspondence with PG&E, that study did not provide a deterministic analysis of a San Simeon-like thrust fault earthquake *directly beneath* DCPP. *See also* the attached correspondence: letter from John L. Geesman to Blair Jones, PG&E, re: Follow-up to seismic update discussion at February 22, 2024 DCISC meeting (Feb. 26, 2024); PG&E Letter DCL-24-064 from Maureen R. Zawalick, PG&E to John Geesman re: Response to Letter from John Geesman Regarding the Seismic Update Discussion at February 2,2, 2024 DCISC Meeting (June 17, 2024); Letter from John L. Geesman to Maureen R. Zawalick, PG&E, re: PG&E Letter DCL-24-064 replying to my letter of February 26, 2024 (June 19, 2024). We urge you to demand accountability by PG&E for its serious misrepresentations and delay in producing the required deterministic study of a San Simeon-like thrust fault earthquake directly beneath DCPP.

and they are reasonable suggestions for general research topics that should be pursued under PG&E's long-term research program. Whether PG&E should launch a formal update to SSC24, as Dr. Bird advocates, is a question that should be addressed after the sensitivity studies recommended by the SRT have been completed.

Dr. Bird's recommendation (iv) proposes to use the doctored Noto24 waveforms to directly drive the DCPP Seismic Probabilistic Risk Assessment. The SRT (2025b, p. 26) offers strong objections to adopting this recommendation: "(1) Noto24 is not suitable as a characteristic earthquake for thrust faulting beneath the Irish Hills, and (2) we are aware of no validated methodology for directly assimilating event-specific (deterministic) waveforms into probabilistic risk assessment. Proper handling of the large uncertainties in hazard estimation dictates that any new empirical hazard information, such as the Noto24 seismograms, should be integrated with existing information at the hazard-modeling stage (PSHA), not the risk-modeling stage (SPRA)."

In addition, we seek an update on the status of your consultation with the Independent Peer Review Panel (IPRP), as required by Section 8 of S.B. 846, Cal. Pub. Util. Code § 712.1(d)(1). As you know, the IPRP's most recent report of June 2024 requests PG&E to "conduct a comprehensive review that includes all fault studies in the region since the previous assessment (PG&E, 2015) and they address the implications for the seismic hazard at DCPP." IPRP Report No. 16 at 38 (Aug. 26, 2024). The IPRP has also stated that it "considers the PG&E Update (2024) report incomplete until it has been revised to fully address and clarify the issues and questions raised in [its] review." Id. To our knowledge, PG&E has not provided the requested information and the meeting previously scheduled by the IPRP for April 2025 was postponed. Therefore, please bring us up to date on the status of your consultation. Thank you for your consideration.

Sincerely,

Diane Curran
Counsel to San Luis Obispo Mothers for Peace

Peter Bird Professor Emeritus
Department of Earth, Planetary, and Space Sciences University of California Los Angeles
Los Angeles, CA 90095-1567
Technical advisor to San Luis Obispo Mothers for Peace

References.

Bird (2024). High Seismic Hazard and Risk at Diablo Canyon Power Plant Due to Thrust Faulting Under the Irish Hills, submitted to the DCISC on October 30, 2024, 27 pp.

Bird (2025). Technical Response to the Review of the Bird Critique with Recommendations for Further Actions, submitted to the DCISC on June 6, 2025, 13 pp.

Donahue, J. L. and Abrahamson, N. A., 2014. Simulation-based hanging wall effects. *Earthquake Spectra*, *30*(3), pp.1269-1284.

PG&E (2015). Seismic Source Characterization for the Diablo Canyon Power Plant, San Luis Obispo County, California, 652 pp.

PG&E (2024). Diablo Canyon Updated Seismic Assessment, 394 pp.

SRT (2025a). Review of the Bird Critique, submitted to the DCISC on May 30, 2025, 98 pp.

SRT (2025b). SRT Review of the Bird Response of 6 June 2025, submitted to the DCISC on August 16, 2025, 30 pp.