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Rochelle Becker follow-up to 4/27/15 workshop

Additional submitted attachment is included below.

ALLIANCE FOR NUCLEAR RESPONSIBILITY

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May 8, 2015

Dr. Robert B. Weisenmiller, Chairman
Commissioner Andrew McAllister
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

transmitted by email to docket@energy.ca.gov

Re: Follow-up Comments Regarding April 27, 2015
Joint Lead Commissioner Workshop on Nuclear Power Plant Issues
Docket No.15-IEPR-12

Dear Chairman Weisenmiller and Commissioner McAllister:

Thank you for convening the April 27, 2015 workshop, which was quite informative in the tradition of past Integrated Energy Policy Report efforts to assess critical vulnerabilities in California's electricity supply system.

I am writing to voice concern about two large gaps left unaddressed by the workshop testimony:

- Where is the deterministic analysis of a San Simeon-type earthquake taking place directly beneath the Diablo Canyon Nuclear Power Plant? The Energy Commission's AB 1632 Report in 2008 made such a study one of its four key recommendations:

  PG&E should assess the implications of a San Simeon-type earthquake beneath Diablo Canyon. This assessment should include expected ground motions and vulnerability assessments for safety-related and non safety-related plant systems and components that might be sensitive to long-period motions in the near field of an earthquake rupture. (at page 7)

- How can the state have allowed PG&E to spend $64.25 million of ratepayer funds on AB 1632 seismic studies, yet miss the six highest-significance hazard contributors identified in Chris Wills' presentation at your workshop? Mr. Wills described the largely reactive role that the Independent Peer Review Panel has played, but surely the Energy Commission and the Public Utilities Commission are not hamstrung by such passivity. I am attaching, for entry in this docket, the Protest which the Alliance recently filed against paying for PG&E's misfeasance with ratepayer funds. But filling the analytical gaps, and assuring that necessary hazard analyses are given appropriate priority and urgency, will require considerably more attentiveness by state government.

I am also attaching a subcommittee report that deserved mention in Jonathan Bishop's presentation. The CEC and CPUC staff representatives were two of four members of a subcommittee to the Water Resources Control Board's Review Committee for Nuclear Fueled Power Plants. The subcommittee unanimously concluded that, *"there is no basis for an exemption"* for DCNPP from the once-through-cooling policy, observing,

> *While the costs for closed cycle cooling are highly uncertain, there is no doubt about the viability of closed cycle cooling in meeting the OTC policy. As a consequence, Diablo Canyon should be required to meet the same standards set forth in the OTC Policy for the other OTC plants under Track 1.*

Again, I thank you for the opportunity to participate in such a valuable workshop.

Sincerely,

/s/

Rochelle Becker
Executive Director

Attachments: A.15-02-023 Protest of Diablo Canyon Seismic Studies

November 18, 2014 Subcommittee Comments on Bechtel's Assessment of Alternatives to Once-Through-Cooling for Diablo Canyon Power Plant

BEFORE THE
PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Compliance Review of Utility Owned Generation Operations, Electric Energy Resource Recovery Account Entries, Contract Administration, Economic Dispatch of Electric Resources, Utility Retained Generation Fuel Procurement, and Other Activities for the Period January 1 through December 31, 2013. (U 39 E)	)	Application 15-02-023 (Filed February 27, 2015)

ALLIANCE FOR NUCLEAR RESPONSIBILITY'S PROTEST

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Date: April 3, 2015

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I. INTRODUCTION.

Pursuant to Rule 2.6 of the Rules of Practice and Procedure of the California Public Utilities Commission ("Commission" or "CPUC"), the Alliance for Nuclear Responsibility ("A4NR") files its Protest to a portion of the 2014 Energy Resource Recovery Account Compliance ("ERRA Compliance") application filed by the Pacific Gas and Electric Company ("PG&E"). A4NR objects to PG&E's recovery of certain balances recorded in the Diablo Canyon Seismic Studies Balancing Account ("DCSSBA") for 2014 costs which fail to comply with D.12-09-008 and D.10-08-003 and, consequently, were not reasonably incurred. Additionally, D.14-08-032 directed PG&E to transfer funding for its Long Term Seismic Program ("LTSP"), including the Senior Seismic Hazard Analysis Committee ("SSHAC") process, to the DCSSBA effective January 1, 2014, subject to reasonableness review in the ERRA Compliance process.[1] A4NR protests recovery of certain LTSP amounts as well.

A4NR's Protest focuses on PG&E's continued evasion of the Independent Peer Review Panel ("IPRP") established by the Commission to assist in the oversight of the ratepayer-funded AB 1632 seismic studies. The legal and factual grounds for the 2014 Protest are similar to those cited in A4NR's protest of PG&E's still-pending 2013 ERRA Compliance application, A.14-02-008, broadened to include the LTSP to the extent that non-compliant avoidance of IPRP review has contaminated core assumptions used in PG&E's SSHAC reports. Sadly, the 2013 evidence cited in A4NR's opening and reply briefs in A.14-02-008 has been augmented by increasingly brazen defiance by PG&E of D.12-09-008 and D.10-08-003, as outlined herein.

[1] D.14-08-032, OP 29 a. The Commission stated, *"We find this disposition to be a reasonable approach to improving oversight of the LTSP costs,"* (*Id.,* p. 411) and, *"We find this disposition to be a reasonable approach to assure the proper integration of Assembly Bill (AB) 1632 seismic studies with the LTSP and the SSHAC process."* (*Id.,* p. 412)

II. CHERRY-PEEVEY EMAILS REVEAL POST-FUKUSHIMA PR PLOY.

A4NR's Protest coincidentally follows the recent revelation of unreported ex parte communications in 2011 between PG&E Vice President Brian Cherry and Commission President Michael Peevey concerning PG&E's A.10-01-022, which sought ratepayer funding for the relicensing of the Diablo Canyon Nuclear Power Plant ("DCNPP"). Five days after the Fukushima accident, ALJ Robert Barnett had taken the A.10-01-022 evidentiary hearing scheduled for April 13, 2011 off calendar. On April 11, 2011 – just one month after the Japanese meltdown -- PG&E ceremoniously announced it would accelerate completion of the AB 1632 seismic studies and requested the U.S. Nuclear Regulatory Commission ("NRC") *"to delay final action on the utility's on-going license renewal application until PG&E submits the findings."*[2]

That same day, Mr. Cherry and President Peevey had the following exchange:[3]

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 2:49 PM
To: Peevey, Michael R.
Subject: FW: Diablo Canyon License Renewal

Attached is the letter mentioned in the press release.

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 4:34 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

Very good. Prudent thing to do and should reduce some fears, concerns.

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[2] "PG&E Commits to Finishing 3-D Seismic Studies Related to Diablo Canyon Before Seeking Final Issuance of Renewed Licenses," news release from PG&E External Communications, April 11, 2011. The release quoted John Conway, Senior Vice President of Energy Supply and Chief Nuclear Officer: *"We recognize that many in the public have called for this research to be completed before the NRC renews the plant's licenses,"* said Conway. *"We are being responsive to this concern by seeking to expeditiously complete the 3-D seismic studies and provide those findings to the commission and other interested parties so that they may have added assurance of the plant's seismic integrity."*

[3] Accessible at ftp://ftp2.cpuc.ca.gov/PG&E20150130ResponseToA1312012Ruling/2011/04/SB_GT&S_0001262.pdf

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 4:47 PM
To: Peevey, Michael R.
Subject: RE: Diablo Canyon License Renewal

...and resurrect our application and get it back on track ?

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 5:04 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

Yep. I will have Carol talk to Barnett.

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 5:05 PM
To: Peevey, Michael R.
Subject: RE: Diablo Canyon License Renewal

Thanks. The sooner the better.

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 5:08 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

May.

From: Cherry, Brian K
Sent: 4/11/2011 5:09:40 PM
To: 'Peevey, Michael R.' (michael.peevey@cpuc.ca.gov)
Cc:
Bcc:
Subject: RE: Diablo Canyon License Renewal

Great. And thanks again.

III. AB 1632 PROGRAM'S REVIEW SAFEGUARDS WERE BREACHED.

A4NR relied upon the establishment of the IPRP by the Commission in D.10-08-003 to ensure that the AB 1632 studies were conducted as robust scientific inquiry and not as a public relations exercise. As ALJ Barnett made clear in that proceeding:

> *And I say this, and I'll say it on the record, that part of this is because I don't want the Commission to be in a position of just accepting what the utilities tell us without looking at it. We've gotten in that position too many times, and I feel that the way to avoid that problem that we are just taking the utility at its word without the expertise to determine the reasonableness of that. That is why I think the IPRP is valuable, and why they should have an expert witness to review this stuff.*[4]

The protocols for IPRP-PG&E interactions articulated in IPRP Report No. 2,[5] repeated verbatim in IPRP Report No. 3,[6] and reinforced by the admonition in D.12-09-008 (*"We expect PG&E to*

[4] A.10-11-015 Transcript, p. 263.

[5] IPRP Report No. 2, September 7, 2011, pp. 8 – 9: *"The IPRP expects that:*

• PG&E will provide its study plans and draft completed study findings to the IPRP for review. These include studies summarized in CPUC Decision 10-08-003 including off-shore, on-shore, and ocean bottom studies, and seismic studies recommended in the AB 1632 Report.
• The IPRP, coordinated by the California Geological Survey (CGS), will review and provide comments on PG&E's study plans. The goal will be, if possible, to provide comments within 30 days of receipt.
• The IPRP, coordinated by the CGS, will review and provide comments on PG&E's draft completed study findings to the CPUC. The goal will be to provide comments as promptly as possible.
• PG&E will review and, if possible, within 30 days incorporate the IPRP's recommendations and comments in PG&E's revised study plans and revised completed study findings and prepare for the IPRP a 'Response to Comments' for the IPRP to document scientifically why PG&E accepted or rejected the IPRP's comments.
• PG&E and the IPRP will participate in quarterly meetings/briefings to review the status of PG&E's seismic studies, any changes in the study plans, and any preliminary study findings.
• PG&E and the IPRP will prepare a master schedule incorporating the major milestones for the IPRP's review process and will include these milestones in PG&E's monthly progress reports and schedule to the NRC and the Atomic Safety and Licensing Board.
• The CPUC and CEC will address any major scientific or technical issues that have not been resolved informally between the IPRP and PG&E. CPUC Decision 10-08-003 states that, 'Should a dispute arise it should be resolved informally but if that is not attainable the Commission has authority to halt the associated rate recovery.' In addition, the CEC may report on any seismic issues and updates through its IEPR process. However, we anticipate that any major scientific or technical issue that may arise can be addressed and resolved informally.

The quarterly briefings/meetings mentioned above will allow PG&E to report on its progress and help facilitate a productive informal exchange of scientific viewpoints."

continue to meet with the IPRP to present and review changes to the seismic study plans, to provide process updates to the IPRP regarding implementation of the studies, and to receive IPRP comments."[7]), offered at least theoretical protection from the PG&E misconduct which surfaced in 2013 and worsened in 2014.

IV. PG&E SENT 'FINAL' REPORT TO THE NRC WITH NO IRPR REVIEW.

PG&E submitted what it labeled the *"final"* AB 1632 report to the NRC on September 10, 2014, six days after the evidentiary hearing in A.14-02-008, and without providing even a draft of the submittal to the IPRP. As the Director of PG&E's Geosciences Department explained at the A.14-02-008 hearing, PG&E had decided that the IPRP was only entitled to receive *"finalized"*[8] results of the studies after PG&E had issued a *"final"*[9] report to the U.S. Nuclear Regulatory Commission.[10]

As described in the evidentiary record of A.14-02-008, the extensive criticism of PG&E's ground motion assumptions at the July 11, 2013 IPRP meeting, followed by the eviscerating IPRP Report No. 6, appears to have significantly chilled relations between PG&E and the IPRP. One month after publication of IPRP Report No. 6, PG&E regulatory affairs personnel were complaining to CPUC staff about self-initiated reports by the IPRP and questioning whether the IPRP could be *"decommissioned"* after submittal of the *"final"* report.[11]

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[6] IPRP Report No. 3, April 6, 2012, pp. 8 – 9.
[7] D.12-09-008, p. 16.
[8] Richard Klimczak, PG&E, A.14-02-008 Transcript, p. 139, ln. 16; p. 141, ln. 14.
[9] *Id*., p. 140, ln. 21; p. 141, ln. 22.; p. 142, ln. 7.
[10] *Id.,* p. 140, ln. 25.
[11] A4NR Opening Brief, A.14-02-008, pp. 27 – 29 citing three internal PG&E emails dated September 16, 2013.

It had taken more than six months of repeated requests by IPRP chair Chris Wills to obtain PG&E's documentation of its V_s measurements at the DCNPP plant site, and his efforts established that PG&E's V_s assumptions had a 50% greater impact on the seismic hazard calculation than the slip rate on the Hosgri Fault, previously labeled the top uncertainty in the PG&E model. And IPRP Report No. 6 was unsparing in its criticism of PG&E's assumptions:

- To prioritize the main targets of the AB 1632 onshore and offshore geophysical studies, the IPRP earlier asked PG&E for sensitivity analyses of the probabilistic hazards. PG&E's 2011 response ranked uncertainty in the slip rate of the Hosgri Fault as clearly the most significant, with a *"calculated ground motion hazard that varies by a factor of nearly 2."*[12]

- Changing PG&E's base case ground motion characterization of V_{S30} of 1200 m/s to a generic site with a V_{S30} of 760 m/s (*"more consistent with other soft rock sites in California"*[13]) "*increases the hazard by more than a factor of 3*"[14] and changing PG&E's assumed site condition to a generic site with a V_{S30} of 1000 m/s "*increases hazard by a factor of 2.*"[15]

- *"Compared to traditional approaches, the PG&E method resulted in lower ground motion hazard estimates, particularly in the spectral period range important to* [Diablo Canyon] *... "* In contrast, *"(a) lower V_{S30} brings the estimated ground motion hazards beyond the original design level when used in typical, state-of-the-practice seismic hazard analysis..."* [16]

- The IPRP questioned whether PG&E's approach adequately captured shear wave velocities at different depths beneath the plant: *"With only three profiles, it is unlikely that one of them represents the lowest velocity material underlying the plant. Some of the variability seen in the 1978 data may reflect poor quality of the V_S measurements made 35 years ago. Interpretations of that data, however, appear to include unconservative assumptions of velocity in boreholes where no velocity was recorded..."*[17]

[12] IPRP Report No. 6, p. 17.
[13] *Id.,* p. 3.
[14] *Id.,* p. 18.
[15] *Id.*
[16] *Id.,* p. 3.
[17] *Id.,* p. 6.

- Nor was newer data from the ISFSI[18] site without problem: *"these two profiles do not give consistent V_s measurements at given depths. Considerable variability exists at some depth ranges ... they do not help constrain the lower bound or range of velocity at the plant site."* [19]

- *"A complete consideration of site conditions across the plant footprint requires additional V_s measurements using modern technology to constrain the uncertainty and yield more reliable site V_s values."*[20]

V. PG&E's 2014 'FINAL' REPORT STONEWALLED IPRP 2013 CRITIQUE.

Despite written assurances to the CPUC staff in response to IPRP Report No. 6 that *"PG&E understands the scientific findings and will conduct the further studies noted,"*[21] and internal acknowledgment within PG&E's Geosciences Department that *"The recommended tasks described in the conclusion are reasonable and we plan to address them as part of our own updated site response evaluation,"*[22] the so-called *"final"* report submitted to the NRC on September 10, 2014 is willfully unresponsive. As summarized in the IPRP's belated review of the ground motion chapters of the 2014 *"final"* AB 1632 report:

- *IPRP Report No. 6 noted that 'V_s data at the DCPP site indicate significant variability /uncertainty' and that **PG&E's estimates "appear to include unconservative assumptions of velocity in boreholes'**. IPRP recommended additional studies to determine the V_s beneath DCPP and the variability of V_s.*[23] (emphasis added)

- *IPRP Report No. 6 recommended that PG&E 'demonstrate that the low site amplification seen at the DCPP site is due to site effects, **not specific to the azimuths and distances traveled by the recorded ground motions at the site from the two earthquakes used'***

[18] "ISFSI" is an acronym for Independent Spent Fuel Storage Installation.
[19] IPRP Report No. 6, pp. 6 – 7.
[20] *Id.,* p. 6.
[21] A4NR Opening Brief, A.14-02-008, p. 30, citing PG&E's October 10, 2013 written response to IPRP Report No. 6.
[22] A4NR Opening Brief, A.14-02-008, p. 31, citing September 9, 2013 email from Dr. Norman Abrahamson to Richard Klimczak.
[23] IPRP Report No. 9, pp. 2 – 3.

and 'justify the adequacy of using only two earthquakes to characterize site amplification'.[24] (emphasis added)

- *In response, PG&E confirmed in a letter to CPUC (PG&E, 2013) that it would conduct further studies to improve the quantification of site conditions and amplification. These studies would: (1) use new data from on-land exploration geophysics surveys to develop a 3D model of shear wave velocity beneath the plant site; (2) analyze broad band ground motion data and ground motions from small earthquakes to better quantify site-specific amplification terms; and (3) evaluate site amplification using analytical approaches in which seismic waves are propagated through a velocity model. The CCCSIP report addressed the first study as discussed in detail in the remainder of this IPRP report,* ***but not the second and third studies****.*[25] (emphasis added)

- *The high-resolution tomographic model of the area near DCPP presented in the CCCSIP report shows details of the variation in interpreted velocity. Important elements of this detailed model include: relatively low near-surface velocities in areas with remaining natural soil; relatively high near-surface velocities underlying much of the plant itself; highly variable estimates of V_{S30}; and irregularly shaped subsurface regions interpreted to have high velocity.*[26]

- *While each of these features of the tomographic model may represent improved understanding of the 'site conditions' at DCPP and may lead to decreased uncertainty in seismic hazard estimates, PG&E has not confirmed the uncertainties in these velocity estimates. Moreover, the CCCSIP report has an extensive discussion of* ***the difficulty of gaining accurate tomographic results at shallow depths, given the constrained source-receiver locations.*** [27] (emphasis added)

- *Differences between V_S profiles measured in 1978 and profiles derived from the tomographic model may reflect poor data or poor resolution in the 1978 profiles. If the 1978 downhole velocity surveys represent 'ground truth', however, it appears that the tomographic model does not show some shallow high velocity layers up to 50' thick or low velocity layers up to 100' thick.* ***The lack of correspondence between measured V_S***

[24] *Id.,* p. 3.
[25] *Id.* The "*final*" AB 1632 Report is also referred to as the "*CCCSIP*" report, an acronym for Central Coastal California Seismic Imaging Project.
[26] *Id.,* p. 4.
[27] *Id.*

profiles and V_S profiles estimated from the tomographic model suggests significant uncertainty remains in estimates of "site conditions" at DCPP. [28] (emphasis added)

- *The IPRP cannot determine if these differences reflect poor data or analysis in one or both measurements of VS or if both surveys are essentially correct, but have differing levels of spatial resolution.* ***Certainly, the differences between VS profiles from the tomographic model and previously measured VS profiles should have been addressed in the CCCSIP report.*** [29] (emphasis added)

- *For the DCPP site, the use of single station sigma with site-specific term appears to be* ***the key factor that brings the deterministic spectra below the original design spectra****.* [30] (emphasis added)

- *While the single station sigma assumption and especially the site term have a significant effect on hazard,* ***the site term is based on the observations of only two earthquakes****.* [31] *As described in IPRP Report No. 6,* ***the IPRP is not convinced that the 'site term' reflects some property of the site that would affect all earthquakes recorded at DCPP****. The alternative hypothesis that additional factors related to the particular source or paths of those two earthquakes remains at least as plausible.* [32] (emphasis added)

- *The CCCSIP report does not include any additional studies to address this issue.* ***The 3D site response analyses proposed by PG&E will not address whether single station sigma model is more reasonable than the ergodic assumption, nor will it reduce uncertainty in the site specific term that is calculated based on two recorded earthquakes***. [33] (emphasis added)

- *Figure 6 compares deterministic spectra for the CCCSIP sensitivity scenario assuming linked co-seismic rupture of the Shoreline, Hosgri, and San Simeon Faults (M7.3). It shows that deterministic ground motion increases across the spectrum as magnitude for the Shoreline Fault rupture increases from 6.7 to 7.3. This figure also shows increased ground motion as V_S30 decreases from 1200 m/s [at the power block foundation level] to*

[28] *Id.,* p. 5.
[29] *Id.,* pp. 5 – 6.
[30] *Id.,* p. 12.
[31] The NRC staff noted this same limitation in its 2012 assessment of PG&E's single-station-sigma adjustment at DCNPP, observing, *"Generally a larger number of earthquakes would be needed to develop confidence in the correction factor."* RIL 12-01, p. 59.
[32] IPRP Report No. 9, p. 12.
[33] *Id.*

760 m/s. ***More significantly, the figure shows, once again, that the most influential factor affecting deterministic ground motion estimates is the single station sigma assumption and the site term****.*[34] (emphasis added)

- ***The 3D response analysis cannot, however, address issues associated with the site-specific term****. IPRP previously expressed its concern regarding the adequacy of using only two earthquakes in estimating the site-specific term and made recommendations to gain confidence in the PG&E site-specific approach, including analyzing broad band ground motion data and ground motions from small earthquakes to better quantify the site-specific term.* ***PG&E has not addressed these recommendations****.*[35] (emphasis added)

- *The "site term" based on two recorded earthquakes may represent other factors, rather than site conditions.* ***IPRP is not convinced that this factor is adequately constrained for use in ground motion calculations****.*[36] (emphasis added)

The IPRP, impeded from performing its duties by PG&E's extended embargo from mid-2013 until the AB 1632 report was "*finalized"* in September 2014, was also critical of certain aspects of PG&E's seismic source characterization when it eventually gained access to the document. IPRP Report No. 8 is particularly pointed in its assessment of PG&E's analysis of onshore faults:

- ***The IPRP is not convinced that the interpretations of the down-dip extensions of faults are well constrained, even in the case of well-documented surface faults****. Similarly, faults interpreted from the seismic sections, but not corroborated by surface mapping, (e.g. faults interpreted between the San Miguelito and Edna faults) are possible, but are by no means unique interpretations of the data.* ***Overall, the IPRP is not convinced that projections of faults beyond the very shallow subsurface represented unique interpretations of the data.***[37] (emphasis added))

- ***Projections of faults to depth in 'basement' rocks of the Franciscan complex appear to be even more problematic.*** *As discussed at the IPRP meeting on November 17, 2014, the Franciscan complex is known to be a mixture of different rock types pervasively*

[34] *Id.*
[35] *Id.,* p. 15.
[36] *Id.*
[37] IPRP Report No. 8, p. 5.

sheared at a variety of scales and is not expected to produce reflectors that are extensive over broad areas. The majority of seismic sections, (e.g. AWD line 150 as presented on Chapter 7, Figure 5-25) show prominent, continuous reflectors at relatively great depths in material that is assumed to be bedrock of the Franciscan complex.[38] (emphasis added)

- *Most deep reflectors shown on Figure 5-25, and in many other sections are arranged in groups of concave-upward, gently curved reflectors. These reflectors are interpreted in the CCCSIP report as representing geological structure.* ***The IPRP, however, regards this pattern of concave-upward sets of reflectors as difficult to explain geologically, but not difficult to envision as artifacts from the data processing. If the continuous reflectors in Franciscan complex bedrock are artifacts of data processing, rather than representing geologic structure, then the seismic reflection surveys provide no constraint on the down-dip geometry of faults in the Franciscan Complex***.[39] (emphasis added)

- *The Los Osos fault, in particular, is entirely within Franciscan Complex rocks from very shallow depths.* ***If the reflection surveys do not show real geologic structure along the down-dip extension of this fault, then dip of the fault remains essentially unconstrained.***[40] (emphasis added)

- *Since the Franciscan complex is known to be a mixture of different rock types pervasively sheared at a variety of scales, continuous, gently dipping layers are not expected.* ***The overall arrangement of the gently dipping 'reflectors' also raises questions that are not addressed in the report. In several sections, the arrangement of reflectors does not resemble a cross-section of folded or faulted rock.*** *The pattern of concave-upward sets of reflectors seen in many sections does not have an obvious geological explanation,* ***leading the IPRP to question whether they represent real geologic structure***.[41] (emphasis added)

- *Even if all reflectors shown in the seismic sections are images of geologic features,* ***the interpretations of various faults are inconsistent and not unique****: 1) In many cases, faults are interpreted based on a series of truncated reflectors, but are shown to pass through other reflectors that are not truncated; 2)* ***In some seismic sections, it appears that additional faults are permitted by the data. It is not clear how the stated interpretation methodology allowed the interpretation team to draw some faults and not others****; and 3) Alternate interpretations of the dip of most faults are possible*.[42] (emphasis added)

[38] *Id.,* p. 6.
[39] *Id.*
[40] *Id.*
[41] *Id.,* p. 7.
[42] *Id.,* pp. 7 – 8.

- *This concern applies to the dip of the Los Osos fault. Alternate dips, including relatively low-angle dips, of the Los Osos fault appear to be possible through sections 138-149 and 150 as shown on Figures 5-24 and 5-25 of the CCCSIP report. The reduction in uncertainty in seismic hazard depicted on the 'tornado diagram' for dip of the Los Osos fault appears to be based on the CCCSIP report conclusion that the new data precludes low-angle dips.* ***The IPRP does not concur that low-angle dips are precluded by this new data and therefore does not believe that these studies have resulted in reduced uncertainty in seismic hazard related to this parameter***. [43](emphasis added)

- *Although surface faults recognized to date appear to be consistent with strike-slip faulting on the Shoreline fault, rather than thrusting on the SLRF, the possibility of thrust faults in the subsurface is not ruled out by on-land seismic survey data.* ***The interpretation of the ONSIP data is far from unique and allows one to interpret a low angle reverse fault at the proposed location, contrary to what is stated in the CCCSIP report (p.70 Figure 6-54). The CCCSIP interpretation criteria are not clearly defined and do not appear consistent in terms of selections made when seismic reflections are truncated***.[44] (emphasis added)

IPRP Report No. 8 emphasizes the curtailed nature of its after-the-fact review,[45] and points out that proper evaluation of PG&E's seismic data acquisition and processing would require the retention of outside consulting services – an authority expressly granted to the IPRP by D.10-08-003[46] and D.12-09-008,[47] and first promised at the IPRP's initial meeting on August 31, 2010,[48] but still unfulfilled as of the date of this Protest. Unsurprisingly, it was the very fear of this predictable IPRP focus on data acquisition and processing that dominated PG&E management's 2013 internal *"risk"* evaluation of a scenario labeled *"IPRP Review"*:

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[43] *Id.,* p. 8.
[44] *Id.,* p. 10.
[45] *"IPRP review of the tectonic model is based on the CCCSIP report and presentation. The IPRP has not had time, to review the seismic data processing in detail."* IPRP Report No. 8, p. 7.
[46] D.10-08-003, p. 11.
[47] D.12-09-008, p. 23.
[48] IPRP Report No. 1, p. 5.

> ***IPRP recommends additional processing of data or interpretations after their review of project results****. The project results and conclusions are to be provided to the Independent Peer Review Panel (IPRP) as a condition of authorized CPUC funding for this project.* ***They could recommend additional processing methods be applied or other interpretation techniques be utilized****. The IPRP make-up does not have members who are experienced in processing and interpretation, but* ***they could seek an independent review by others****.*[49] (emphasis added)

IPRP Report No. 9 also describes more recent obstruction to its review of PG&E's ground motion assumptions:

> *Following the public meeting on January 8, 2015, the IPRP had a number of additional questions regarding the velocity model described in Chapter 10 and requested an additional meeting with PG&E.* ***PG&E declined to meet again with IPRP****. As a result, this report only covers aspects of those models described in the CCCSIP report and the public meeting.*[50] (emphasis added)

PG&E's successful strategy to circumvent meaningful IPRP review, originally formulated in 2013 and implemented as a reaction to the devastating IPRP Report No. 6, culminated with submittal of a deeply flawed *"final"* AB 1632 Report to the NRC in 2014. As of the date of this Protest, A4NR has had insufficient time to determine the degree to which adulterated assumptions from the inadequately reviewed AB 1632 Report have driven the conclusions of the LTSP's recent SSHAC Report. The cynical fashion in which PG&E's recent publicity offensive has invoked the hamstrung IPRP review to promote the rosy conclusions of the SSHAC Report leaves little room for doubt:

[49] A4NR Opening Brief, A.14-02-008, p. 4, quoting a March 28, 2013 submittal to PG&E's Executive Project Committee by Ed Halpin, Jeff Summy, and Richard Klimczak.
[50] IPRP Report No. 9, p. 2.

- *Independent experts also included an evaluation of the advanced seismic studies recently performed near Diablo Canyon, **as well as feedback on the research provided from a state-appointed independent peer review panel**.*[51] (emphasis added)

- *Their work also utilized insight gained from the advanced seismic studies recently completed near Diablo Canyon. **In addition, input on the advanced seismic studies provided by the California Public Utilities Commission's Independent Peer Review Panel was considered in the seismic hazard re-evaluation process**.*[52] (emphasis added)

- [This] *work also included an evaluation of the advanced seismic studies recently performed near Diablo Canyon, **as well as feedback on the research provided from a state-appointed independent peer review panel**.*[53] (emphasis added)

VI. DR. BLAKESLEE SPOTLIGHTS PG&E's DECEPTIVE PATTERN.

Leave it to the author of AB 1632, Dr. Sam Blakeslee, the former Exxon geophysicist who served as Republican Minority Leader of the California State Assembly, to assess the degree to which the $64.25 million ratepayer-funded seismic studies have been subverted. As Dr. Blakeslee observed in December 3, 2014 testimony to the U.S. Senate Environment and Public Works Committee, over several decades PG&E has discovered more faults in close proximity to the plant, attributed greater capability to the faults which it has acknowledged, yet consistently proclaimed the seismic risk at the plant to be diminishing: *"The potential earthquakes affecting the plant have increased with each major study. But what's equally striking is that the shaking*

[51] "*Confirming Diablo Canyon Plant's Safety*," Ed Halpin, Lompoc Record, March 14, 2015.
[52] *"Seismic and tsunami safety a priority for Diablo Canyon,"* Ed Halpin, San Luis Obispo Tribune, March 19, 2015.
[53] *"Op/ed: PG&E exec answers critics, says Diablo Canyon is safe, secure,"* Ed Halpin, Pacific Coast Business Times, March 20, 2015.

predicted by PG&E for these increasing threats has systematically decreased as PG&E adopted less and less conservative analytical methodologies..." [54]

Dr. Blakeslee was especially critical of PG&E's debased *"final"* AB 1632 Report:

> *... in a seeming contradiction, rather than finding that larger or closer faults produce greater shaking and therefore a greater threat, PG&E argues in the Report that ground motion will be lower than the levels previously estimated. In other words, these newly discovered and re-interpreted faults are capable of producing shaking that exceeds the shaking from the Hosgri, yet that shaking threat would be much reduced from prior estimates.*
>
> *Though discussed only in passing in the Report, the reason for this seeming contradiction is quite important when assessing whether or not the plant is safe or whether it is operating within its license conditions. The reason the earthquake threat purportedly went down when new faults were discovered is because the utility adopted significant changes to the methodology utilized for converting earthquakes (which occur at the fault) into ground motion (which occurs at the facility). This new methodology, which is less-conservative than the prior methodology, essentially "de-amplifies" the shaking estimated from any given earthquake relative to the prior methodology used during the licensing process.*[55]

PG&E's "*final*" AB 1632 Report artfully avoids an apples-to-apples comparison which would isolate the influence of its continuously evolving ground motion prediction methodology. The charts on pages 13 – 15 of the Technical Summary, attached to this Protest as Appendix A, purport to contrast the spectra derived from the AB 1632 studies against the 1977 Hosgri evaluation and the 1991 LTSP analysis. Neglecting to reveal the radically different methods for predicting ground motions between cases has the same power of deception as assembling a financial spreadsheet mixing different vintages of dollars without disclosure. To the extent

[54] Written Statement by Sam Blakeslee, Ph.D, to the Senate Committee on Environment and Public Works, December 3, 2014, p. 3. Dr. Blakeslee's complete statement is accessible at http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=42d07682-cad9-49f4-bbf1-fc9757f624c9

[55] *Id.,* p. 5.

that PG&E intended anyone to rely upon the misrepresentations-by-omission contained in these charts, and such reliance were to occur, the common law uses a certain f-word to describe such conduct.

VII. PG&E's POST-CCCSIP CONTEMPTUOUS DISCLOSURE.

Having successfully circumvented the IPRP before submitting its *"final"* report to the NRC, and choosing to absorb the criticism of IPRP Report No. 8 without response, the PG&E Geosciences Department could not resist engaging in its own form of end-zone dance at the January 8, 2015 meeting of the IPRP. With peculiar aplomb, Dr. Norman Abrahamson blithely distributed a new hazard sensitivity chart, attached to this Protest as Appendix B, and acknowledged that the six highest ranked uncertainties (each relating to earthquake-induced ground motions at the plant) had never before been presented to the IPRP. Despite admitting that PG&E's void of site-specific ground motion data dominates Diablo Canyon's probabilistic seismic hazard, Dr. Abrahamson nonchalantly suggested this deficiency be addressed in PG&E's 2025 update. There was no mention of the staggering difference in magnitude between the six newly identified uncertainties and the ones which had been selected for the AB 1632 studies.[56]

His unmistakable message: having feasted on a $64.25 million authorization for ratepayer-funded studies, we never addressed the most significant issues or even told you what they were. But now we've run out the clock. Too bad, chumps.

[56] Dr. Abrahamson's discussion of the new hazard sensitivity chart runs from 1:51:27 to 2:03:25 in the video of the January 8, 2015 IPRP meeting, accessible at http://youtu.be/hXu_vn5gxMU

VIII. TO LIVE OUTSIDE THE LAW YOU MUST BE HONEST.

The light-handed oversight previously afforded PG&E in the conduct of its AB 1632 studies appears to be a legacy of the Commission's discredited, pre-San Bruno voluntary compliance era. As Executive Director Paul Clanon memorably testified to a California Senate committee, *"That can be characterized as 'self-reporting,' but a better way to look at it is creating a safety culture at the utility."*[57] He later explained that, in lieu of fines, *"a better way to ensure safety is to make sure that a utility sees violations on its own has every incentive to report them."*[58] As Mr. Clanon told a post-explosion community meeting in San Bruno, fines might *"discourage the utilities to come forward when they see a problem. A utility doesn't want their pipelines to be unsafe."*[59]

A4NR does not contend that PG&E **wants** DCNPP to be seismically unsafe. Rather, the accumulated record of PG&E's performance of its AB 1632 seismic studies documents a furtive, thumb-on-the-scale approach designed primarily to quell public apprehension and forestall pressure to close the plant. PG&E has received special dispensation from the NRC since October 12, 2012 to defer application of the Double Design Earthquake ("DDE") standard to the Shoreline Fault until submittal of the DCNPP SSHAC analysis -- despite the NRC's acknowledgment that *"using the DDE as the basis of comparison will most likely result in the Shoreline fault and the Hosgri earthquake being reported as having greater ground motion"*

[57] "PG&E Hammered Over Safety Issues," San Mateo Times, October 19, 2010.
[58] "State's gas pipeline inspections found to lag," San Francisco Chronicle, November 14, 2010.
[59] "San Bruno blast victims skeptical of PUC oversight," San Francisco Chronicle, December 8, 2010.

than the plant's Safe Shutdown Earthquake.[60] This remarkable prediction was repeated by Dr. Cliff Munson, an NRC seismologist, in testimony to a June 19, 2013 California Energy Commission workshop.[61] The indifference with which California state agencies have, at least publicly, accepted this revelation has been alarming but the financial bottom line is undeniable: significant seismic retrofit requirements seem likely to be required.[62]

A4NR does not expect the CPUC to involve itself in questions of the seismic licensing basis of DCNPP or the prudence of the manner in which the NRC has addressed the seismic licensing basis issue.[63] Instead, A4NR expects the Commission to be diligent in its application of traditional ratemaking authority to protect California's economic interest and electricity reliability interest in accurately understanding the seismic challenges facing the plant. The Commission would be derelict in meeting this responsibility by relying exclusively on PG&E's good faith or commitment to scientific objectivity.

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[60] Letter to Edward D. Halpin from Joseph M. Sebrosky, NRC Senior Project Manager for Plant Licensing Branch IV, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, October 12, 2012, accessible at http://pbadupws.nrc.gov/docs/ML1207/ML120730106.pdf

[61] Lead Commissioner Workshop on California Nuclear Power Plant Issues, Docket No.13-IEP-1J, June 19, 2013, Transcript, p. 89, accessible at http://www.energy.ca.gov/2013_energypolicy/documents/2013-06-19_workshop/2013-06-19_nuclear_workshop_transcript.pdf

[62] The severity of any such requirement is suggested by PG&E's 2012 submittal to the NRC of a 331-page list of DCNPP deviations from the *"new plant"* criteria Dr. Munson testified will be applied: *""The thing I want to emphasize is that the hazard evaluations are based on current practices for new reactors." Id.,* p. 81. PG&E's 331-page list of deviations is accessible at http://pbadupws.nrc.gov/docs/ML1134/ML11342A238.pdf

[63] The Union of Concerned Scientists reported in 2013 that, of the 100 reactors currently operating in the U.S., the two at Diablo Canyon top the NRC's list as being most likely to experience an earthquake larger than they are designed to withstand, using NRC data to calculate the probability of such an event as more than 10 times greater than the nuclear fleet average. "Seismic Shift: Diablo Canyon Literally and Figuratively on Shaky Ground," Union of Concerned Scientists, November 2013, p. 7, accessible at http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/diablo-canyon-earthquake-risk.pdf

PG&E is the only NRC power plant licensee in the history of the commercial nuclear power industry to face criminal indictment for safety-related violations by the U.S. Department of Justice. While the 27 safety-related felony counts in PG&E's federal grand jury indictment are focused on the company's gas division, it strains credulity to believe that DCNPP has been somehow immunized from the corporate culture rot that recently prompted Commission President Michael Picker to acknowledge during a California Senate oversight hearing that, *" I think there's a very clear case that in some places, the utility did divert dollars that we approved for safety purposes for executive compensation."*[64] And the obstruction of justice felony count which leads PG&E's federal indictment emphatically addresses management as a whole:

> *"On or about September 10, 2010, and continuing through on or about September 30, 2011, in the Northern District of California, the defendant, PACIFIC GAS AND ELECTRIC COMPANY,* ***did corruptly influence, obstruct, and impede****, and did endeavor to influence, obstruct, and impede* ***the due and proper administration of the law*** *under which a pending proceeding was being had before a department and agency of the United States ..."*[65] (emphasis added)

Although perhaps not a matter of familiarity to utility regulators, the term *"RAP sheet"* is derived from the Federal Bureau of Investigation's Record of Arrests and Prosecutions. Actual conviction is not a prerequisite. A4NR is unaware of any other California electric utility with a RAP sheet. While PG&E is certainly entitled to its day(s) in court to defend itself from the federal charges, its status as a criminal defendant and the nature of its alleged crimes should

[64] President Picker's statement is at 36:56 of the video of the March 25, 2015 oversight hearing conducted by the California Senate Committee on Energy, Utilities and Communications, accessible at http://calchannel.granicus.com/MediaPlayer.php?view_id=7&clip_id=2682

[65] United States of America v. Pacific Gas and Electric Company, United States District Court for the Northern District of California, Case 3:14-cr-00175-THE, Superseding Indictment, July 29, 2014, p. 18.

discourage the Commission from extending any presumption of veracity to the representations in PG&E's AB 1632 Report without corroboration by the most rigorous scrutiny.

IX. WHY A4NR PROTESTS.

Building upon key decisions made and implemented by PG&E in 2013, the utility intensified its efforts in 2014 to subvert what was originally conceived by the Commission as a robust re-evaluation of DCNPP's seismic setting. If PG&E is allowed to recover the costs of such subterfuge, the effect on A4NR and all PG&E customers will be electricity rates rendered both unreasonable and unjust by Commission reward of unmistakable perfidy. The consequences for A4NR members (and others) living in communities near the plant stemming from unknowing acceptance of PG&E's defective seismic analysis could, in some circumstances, be much worse than that – with incalculable financial impact on California.

A4NR requests evidentiary hearings and will conduct discovery and sponsor testimony elaborating on the facts contained in this Protest, as well as the extent to which PG&E's LTSP and SSHAC expenditures in 2014 were similarly tainted. Assuming timely responsiveness by PG&E to legitimate discovery requests, A4NR has no objection to the schedule proposed in PG&E's application.

The undersigned will be the A4NR's principal contact in this proceeding, but A4NR also asks that the following two individuals be placed in the *"information only"* category of the Service List:

Rochelle Becker
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David Weisman
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Respectfully submitted,

By: /s/ John L. Geesman

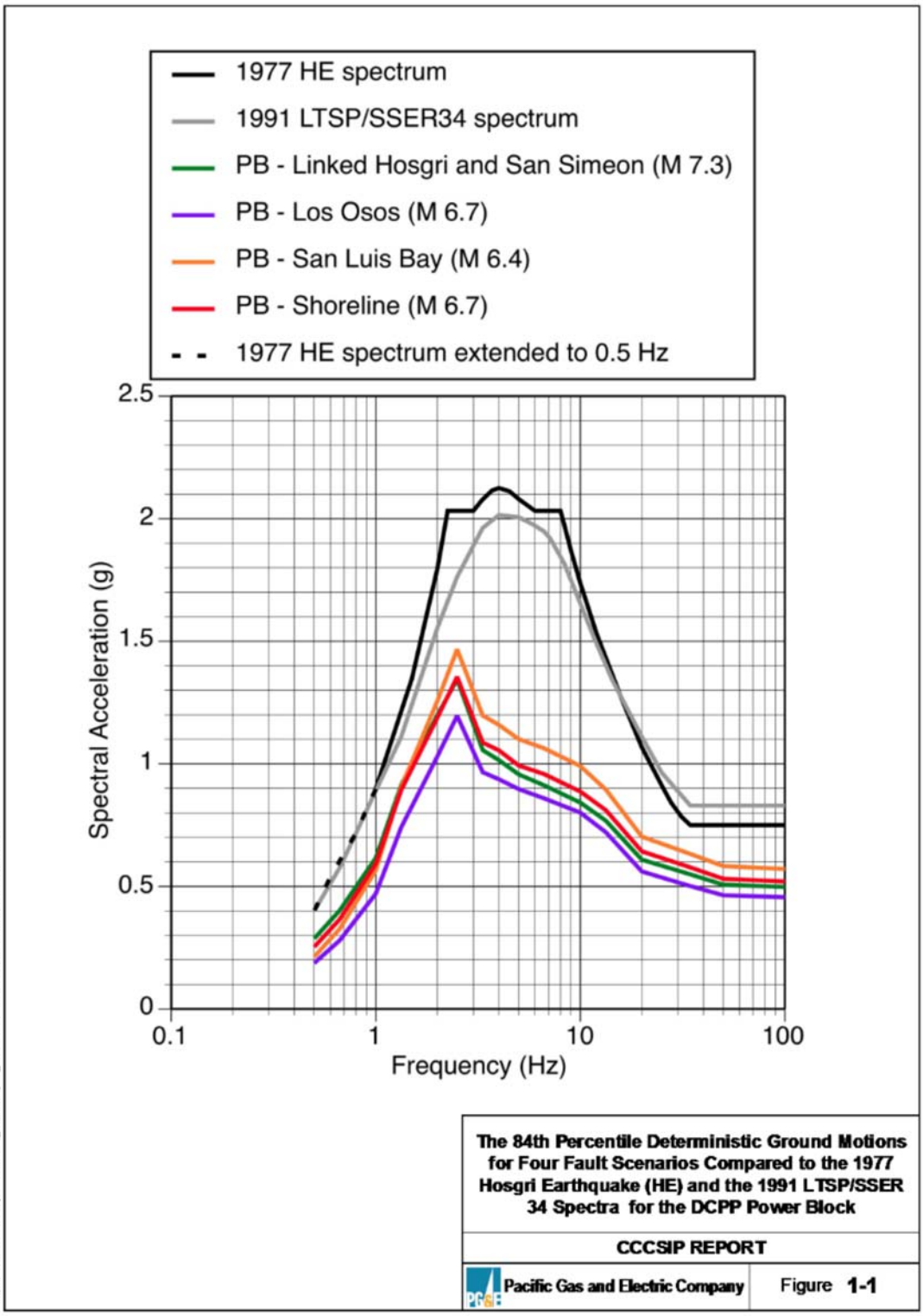
JOHN L. GEESMAN
DICKSON GEESMAN LLP

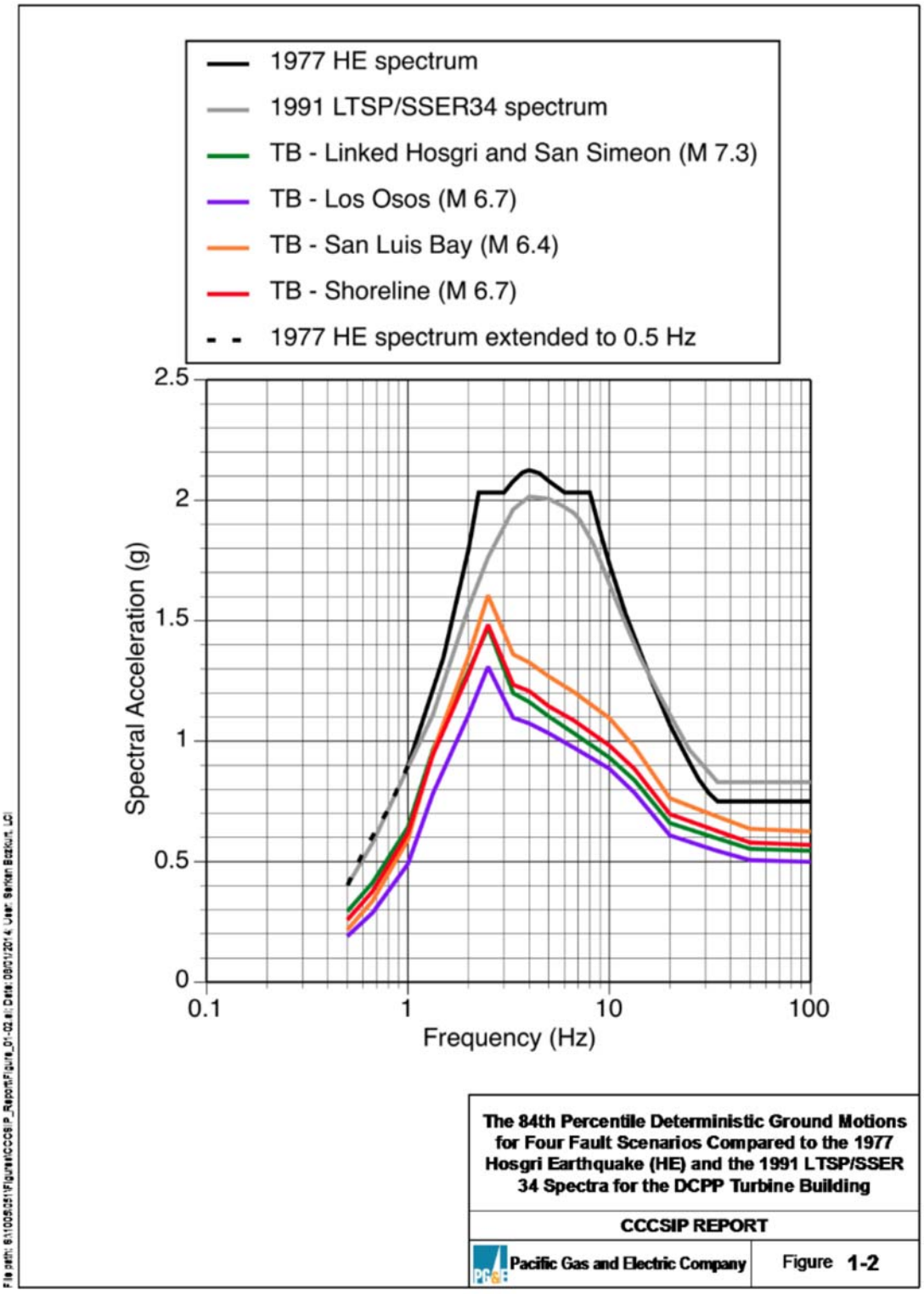
Date: April 3, 2015

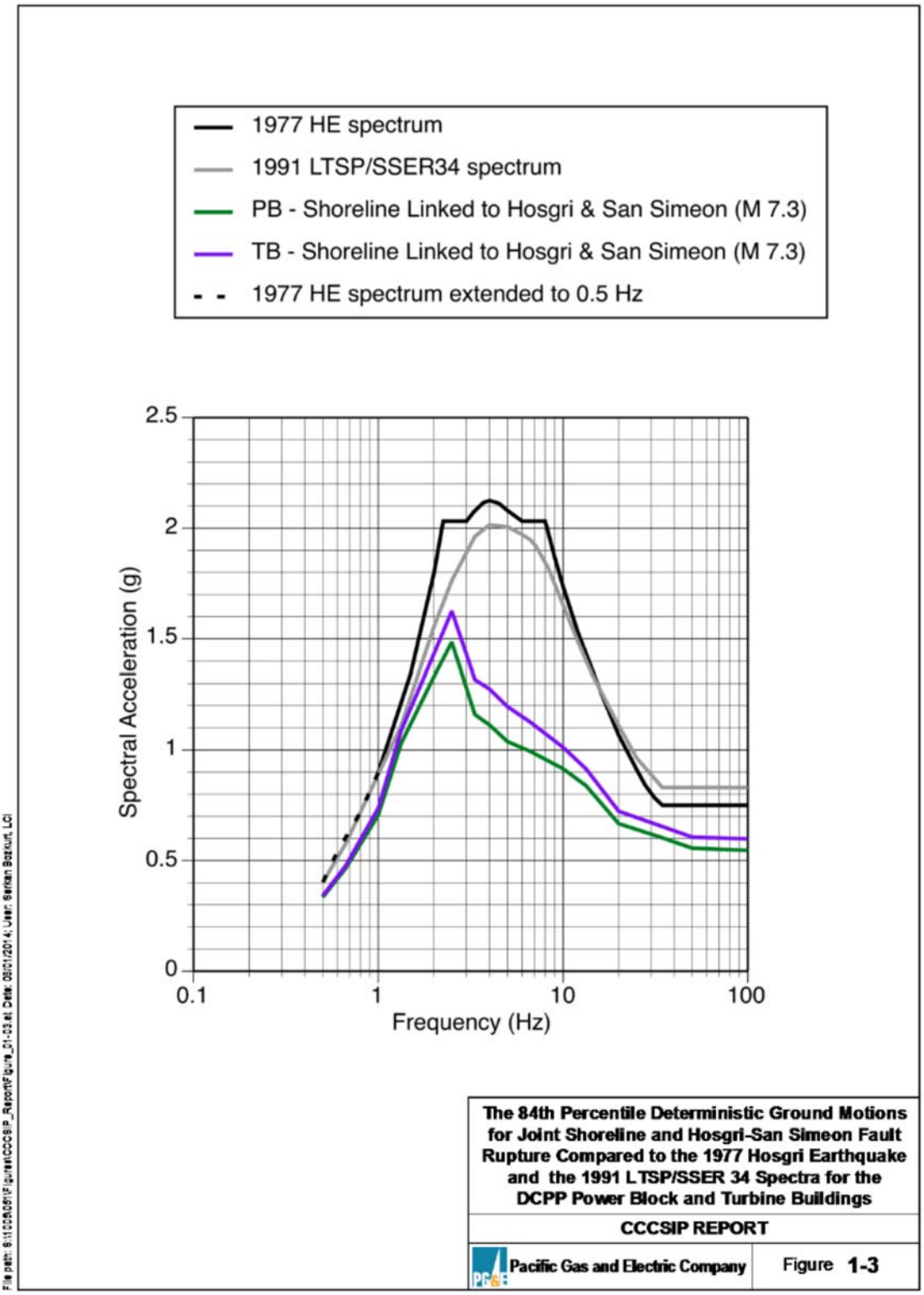
Attorney for
ALLIANCE FOR NUCLEAR RESPONSIBILITY

APPENDIX A

PG&E SPECTRA CHARTS FROM CCCSIP REPORT


1977 HE spectrum
1991 LTSP/SSER34 spectrum
PB - Linked Hosgri and San Simeon (M 7.3)
PB - Los Osos (M 6.7)
PB - San Luis Bay (M 6.4)
PB - Shoreline (M 6.7)
1977 HE spectrum extended to 0.5 Hz
Spectral Acceleration (g)
Frequency (Hz)
0
0.5
1
1.5
2
2.5
0.1
1
10
100
The 84th Percentile Deterministic Ground Motions for Four Fault Scenarios Compared to the 1977 Hosgri Earthquake (HE) and the 1991 LTSP/SSER 34 Spectra for the DCPP Power Block
CCCSIP REPORT
Pacific Gas and Electric Company
Figure 1-1

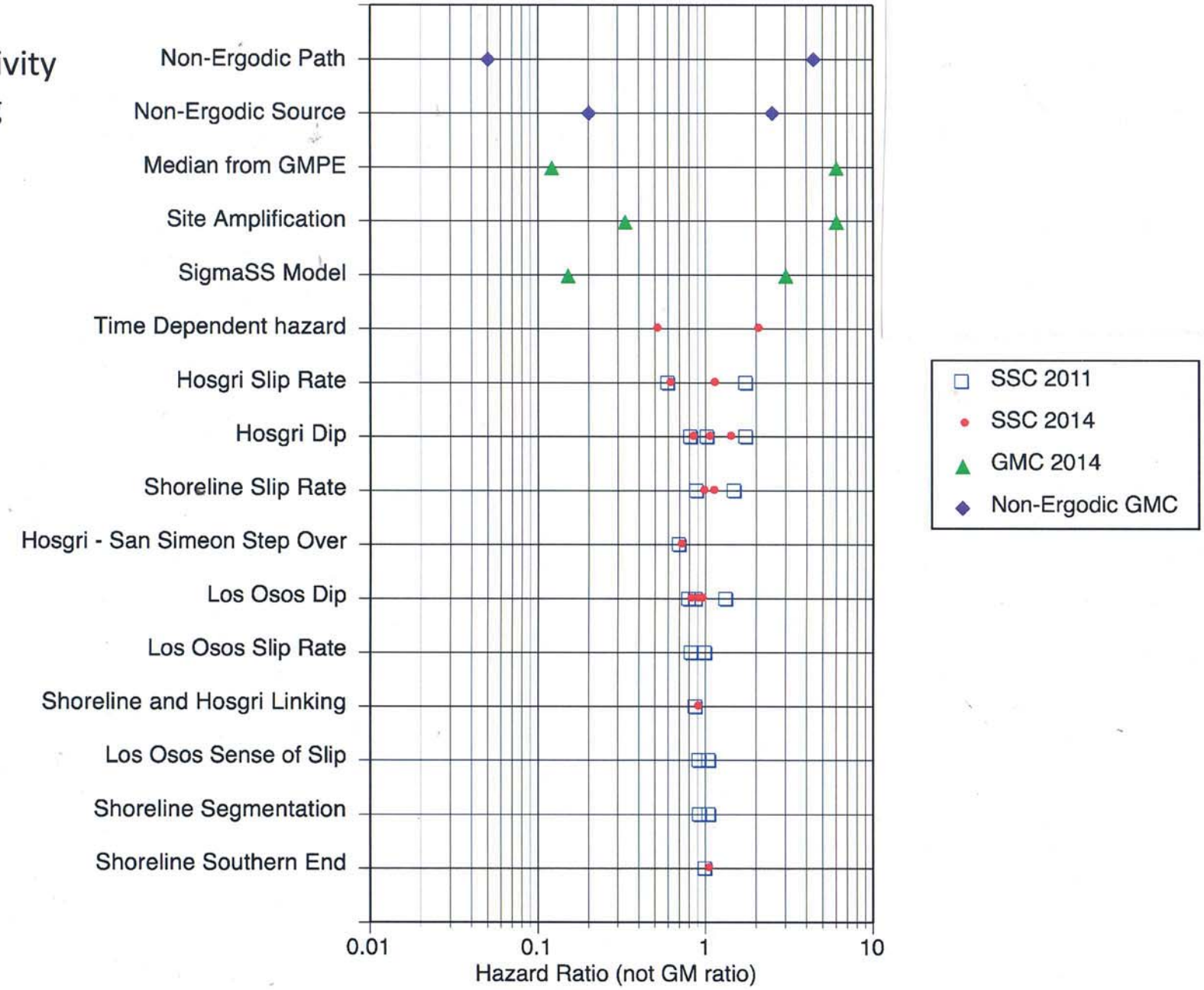

1977 HE spectrum
1991 LTSP/SSER34 spectrum
TB - Linked Hosgri and San Simeon (M 7.3)
TB - Los Osos (M 6.7)
TB - San Luis Bay (M 6.4)
TB - Shoreline (M 6.7)
1977 HE spectrum extended to 0.5 Hz
Spectral Acceleration (g)
Frequency (Hz)
0
0.5
1
1.5
2
2.5
0.1
1
10
100
The 84th Percentile Deterministic Ground Motions for Four Fault Scenarios Compared to the 1977 Hosgri Earthquake (HE) and the 1991 LTSP/SSER 34 Spectra for the DCPP Turbine Building
CCCSIP REPORT
Pacific Gas and Electric Company
Figure 1-2


1977 HE spectrum
1991 LTSP/SSER34 spectrum
PB - Shoreline Linked to Hosgri & San Simeon (M 7.3)
TB - Shoreline Linked to Hosgri & San Simeon (M 7.3)
1977 HE spectrum extended to 0.5 Hz
Spectral Acceleration (g)
2.5
2
1.5
1
0.5
0
0.1
1
10
100
Frequency (Hz)
The 84th Percentile Deterministic Ground Motions for Joint Shoreline and Hosgri-San Simeon Fault Rupture Compared to the 1977 Hosgri Earthquake and the 1991 LTSP/SSER 34 Spectra for the DCPP Power Block and Turbine Buildings
CCCSIP REPORT
Pacific Gas and Electric Company
Figure 1-3

APPENDIX B

PG&E LATE-DISTRIBUTED HAZARD CHART

Hazard Sensitivity
5 Hz, PSA = 2g



November 18, 2014

Subcommittee Comments on Bechtel's Assessment of Alternatives to Once-Through-Cooling for Diablo Canyon Power Plant[1]

Recommendations Overview

The Subcommittee of the Review Committee for Nuclear Fueled Power Plants (the Subcommittee) finds that there is no basis for an exemption from the once-through-cooling (OTC) Policy for Diablo Canyon Power Plant (Diablo Canyon). Based on the special study on alternatives to OTC for the state's nuclear facilities, the Subcommittee concludes that closed cycle cooling is a viable technology that could ensure Diablo Canyon's compliance with the state's OTC Policy. While there is a wide range of estimated costs associated with the closed cycle cooling technology, the Subcommittee believes that the only definitive way to determine the costs of retrofitting Diablo Canyon is for the utility to competitively bid the project with appropriate risk management and performance terms.

The fine mesh and wedge wire screen technologies assessed in the study do not appear viable despite having lower costs. There are serious questions regarding the effectiveness of the screens in reducing entrainment and impingement impacts. In addition to being ineffective in reducing marine impacts to the level necessary to meet the OTC Policy, the screen technologies are likely to face significant challenges in dealing with the level of debris loading anticipated at the site. The wedge wire screen technology faces the additional challenge that there has been no industrial experience at scale with this technology. At a minimum, several years of expensive research, development, and pilot testing would be necessary to prove out the concept, and the outcome is not likely to be successful.

In order to give the utility and its regulators sufficient time and appropriate information to make the best decision regarding relicensing, the Subcommittee recommends that Water Board make compliance with the Track 1 of the OTC Policy a condition for relicensing rather than requiring adoption of a date certain on the current license. This will allow consideration of the economic, safety, and environmental implications of closed cycle cooling and other viable cooling options at Diablo Canyon along with all of the other important considerations associated with relicensing of the plant, including seismic issues and the economics of aging reactors.

[1] These comments were prepared by a Subcommittee of the Review Committee for Nuclear Fueled Power Plants consisting of representatives from the California Energy Commission, California Public Utilities Commission, the Center for Energy Efficiency and Renewable Technologies and the Alliance for Nuclear Responsibility.

Introduction

In October, 2010, the State Water Resources Control Board (the Water Board) adopted its OTC Policy to address ongoing marine impacts from the use of coastal and estuarine waters for power plant cooling in the state. The OTC Policy is a technology-based standard that will address the adverse effects associated with these cooling water withdrawals without disrupting the critical needs of the state's electricity system. The OTC Policy applies to 19 existing power plants, including two nuclear plants, at which the intake flow rate must be reduced to the level attained by a closed-cycle wet cooling system.

The OTC Policy requires special studies, conducted by an independent third party, for the state's two nuclear-fueled power plants, Diablo Canyon and San Onofre Nuclear Generating Station (SONGS).[2] The special studies are designed to "investigate alternatives for the plants to meet the policy's requirements." The Review Committee for Nuclear Fueled Power Plants (Review Committee) oversaw the studies and was asked to submit comments on the ability of these plants to achieve compliance, the cost of compliance, and potential environmental impacts of compliance. A Subcommittee consisting of four representatives serving on the Review Committee has prepared these comments to the Water Board.[3]

The Subcommittee comments discuss the following issues:

- The process for completing the technical studies on alternatives to OTC for nuclear plants.
- The importance of reducing marine impacts from Diablo Canyon, the single largest user of marine and estuarine waters for power plant cooling.
- The viability of alternative cooling options, including closed cycle cooling at Diablo Canyon, to meet the OTC Policy and their associated costs and environmental impacts.
- The need to consider OTC requirements for Diablo Canyon in the context of the other issues that will affect its operation beyond its current operating licenses.

[2] The assessment of alternatives to OTC for SONGS was discontinued after Southern California Edison (SCE) made the decision to permanently close the facility in June, 2012. Continued OTC withdrawals are needed to meet critical safety requirements associated with operation of the on-site spent fuel pool, but they have been reduced by 96% since October 1, 2013 and the plant is now in compliance with the OTC Policy.

[3] The Subcommittee limited its' members to four in recognition of the Bagley-Keene Open Meetings Act, which requires a public meeting when a quorum of the Review Committee members meets. The Subcommittee was unable to incorporate comments from other Committee members as a public meeting was not within the Water Board's scheduling considerations.

Review Committee Oversight of Special Studies

The Review Committee was convened by the Water Board and composed of representatives from the state and regional agencies, utilities, and the environmental community.[4] The Water Board selected Bechtel Power Corporation (Bechtel), based on a solicitation conducted by PG&E and SCE, to serve as an independent third party with nuclear plant engineering experience to perform the study.

The Nuclear Committee met 16 times in publicly noticed meetings beginning on March 2011. Several organizations provided comments and input at these open meetings including the Natural Resources Defense Council, Heal the Bay, Surfrider Foundation, Friends of the Earth (FOE) and Diablo Canyon Independent Safety Committee (DCISC). The Final Phase 1 Reports on Diablo Canyon Power Plant and SONGS were posted for public comment in November, 2012. The second phase of the study for SONGS was discontinued due to SCE's decision to permanently close the facility in June, 2012 and OTC withdrawals have been reduce by 96%. The Phase II Draft Report on Diablo Canyon was posted for public comment in September, 2013.

The first phase of the study assesses the viability of eight potential technologies to meet the OTC Policy that were indentified in the Review Committee's Scope of Work.[5] These technologies were assessed against a set of evaluation criteria, which included whether the technology was first of a kind to scale, operability, impingement/entrainment design, environmental impacts, seismic and tsunami, structural, construction, and maintenance issues. In a second phase of the assessment, technically feasible technologies were then reviewed in more detail, which included developing preliminary designs, evaluating costs and schedules, and conducting a nuclear specific assessment.

In November, 2013, after release of Bechtel's preliminary cost estimates, Friends of the Earth (FOE) requested that the Review Committee hold a public meeting so they could present an evaluation of Bechtel's cost and schedule estimates. Based on the input from FOE and other parties, along with Bechtel's responses to the FOE comments, the Review Committee requested that Bechtel assess the costs of a potentially less expensive salt water cooling system located within the existing footprint of the plant, even though it would delay the completion of the project.

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[4] Members of the Review Committee included representatives from the Water Board, the California Coastal Commission, the California Energy Commission, the California Public Utilities Commission, the Central Coast Water Quality Control Board, the San Diego Regional Water Quality Control Board, Pacific Gas and Electric, Southern California Edison, Alliance for Nuclear Responsibility and the Center for Energy Efficiency and Renewable Technologies.

[5] *Scope of Work Report by the Review Committee to oversee Special Studies for the Nuclear Fueled Power Plants Using Once through Cooling,* Review Committee for Nuclear Fueled Power Plants, November 7, 2011.

Diablo Canyon OTC impacts

Diablo Canyon, with a design flow of 2.5 billion gallons per day (BGD) and is responsible for nearly 80 percent of the combined average withdrawals of all OTC power plants (7.9 BGD) in the state.[6] As the environmental document for the OTC Policy states: "The consensus among regulatory agencies both at the state and federal levels is that OTC systems contribute to the degradation of aquatic life in their respective ecosystems."[7] The Water Board notes that these OTC systems, many of which have been in operation for 30 years or more, present a considerable and chronic stressor to the state's coastal aquatic ecosystems by reducing important fisheries and contributing to the overall degradation of the State's marine and estuarine environments.[8]

Over the course of a year, billions of fish eggs and larvae are removed from coastal waters, or entrained, as they are drawn through the cooling systems of power plants. In addition, millions of adult fish are lost due to impingement when they are trapped against screens meant to exclude larger objects from entering the cooling system. The accepted premise among industry and regulatory agencies is that the number of organisms entrained is more or less proportional to the water volume withdrawn through the intake structure.[9] Reduced intake flow is also assumed to reduce the impingement rates.[10] Due to the large withdrawals of seawater on a continuous basis at Diablo Canyon, an estimated 1.5 billion larvae are entrained and 710 pounds of fish are impinged annually. [11]

The Water Board staff considered whether the nuclear facilities should be exempted from the OTC Policy and concluded that the impacts of OTC operation at nuclear facilities, including Diablo Canyon, "have not been sufficiently addressed such that they can be considered compliant with Section 316(b)'s technology-based mandate."[12] They further note that excluding the nuclear facilities would ignore a significant portion of all OTC related impingement and entrainment losses in the state's coastal aquatic communities. One of the major benefits of the premature closure of SONGS is an over 90 percent reduction in OTC damages to the waters surrounding the reactors. That leaves Diablo Canyon as the state's largest contributor to OTC impacts.

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[6] *Diablo Canyon: 78 Percent of California Coastal Power Plant Once-Through Cooling Water Withdrawals*, Supplement to Comments of Friends of the Earth, Bill Powers, P.E., November 23, 2013.
[7] *Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling: Final Substitute Environmental Document*, State Water Resources Control Board, May 4, 2010, p. 29.
[8] Ibid. p. 1.
[9] Ibid. p. 60.
[10] Ibid. p. 60.
[11] Diablo Canyon is a base load power plant that is run at close to the maximum output for long periods of time except during scheduled outages for refueling or forced outages.
[12] Ibid. p. 51-52.

Evaluation of Alternatives to OTC

Bechtel determined that inshore mechanical intake fine mesh screens and offshore modular wedge wire screens, as well as five variations of closed cycle cooling systems (except for wet cooling using seawater for makeup) were technically feasible for Diablo Canyon.[13] A discussion of the design issues for the alternative options (including a nuclear-specific assessment) and their potential environmental impacts, along with the costs and schedules for implementing the different options is presented below.

Wedge Wire and Fine Mesh Screens

Design Considerations

For the onshore mechanical fine mesh screen technology, six of the existing flow-through mesh traveling screens (10 ft by 30 ft with 9.5 mm mesh) at Diablo Canyon would be replaced with dual flow traveling screen with smooth woven mesh with 1-6 mm rectangular slots. Fine mesh screen technology only reduces the through screen velocity from 1.95 fps to 1 fps, while the OTC Policy requires a through-screen velocity of 0.5 fps. Bechtel indicated that for both screen technologies the potential for debris loading favors large screen slot sizes, while small slot sizes are needed to provide entrainment and impingement benefits.

The offshore modular wedge wire screen system involves 30 screens that are 8 ft by diameter and 35 foot long, with a 6 mm slot size.[14] The existing water intake cove would be closed to form a shoreline basin and a new 1000 ft. circulating water conveyance would be needed from the basin to the ocean.[15] A tunnel that is 30-32 feet in diameter would be constructed using a tunnel-boring machine. The open sea oceanography at Diablo Canyon is difficult for such a project with high waves, wind and rainfall along with kelp and algae production.

The DCISC raised several concerns about the screen technologies related to Bechtel's conclusion that no Nuclear Regulatory Commission (NRC) license amendment request (LAR) is likely to be needed for the two options evaluated.[16] The DCISC concluded that "this assessment is questionable for the offshore, modular wedge wire system, because this option requires the installation of a new, safety-related stop-log system in the plant

[13] Wet cooling with salt water was initially eliminated by Bechtel based primarily on their assumption that limited PM 10 credits in the regional air quality district would preclude this option. This premise was later challenged and a salt water cooling option was subsequently evaluated by Bechtel.
[14] A 1 mm slot size would require 48/ 8 ft wedge wire screens.
[15] Bechtel examined both a buried pipeline and tunnel options and selected the tunnel option because it was less expensive.
[16] Letter to Jonathan Bishop, State Water Resources Control Board from Per R. Peterson, DCISC, September 5, 2013, Appendix A, p. 4-5.

intake cove," which they believe will "certainly require a NRC LAR." The DCISC found that Bechtel's conclusion that no LAR would be needed "might be correct for the inshore fine-mesh screening system option, because this option involves the least extensive modifications to the plants."

Potential Environmental Impacts

The Review Committee requested that Tenera Environmental conduct an assessment of the impingement and entrainment impacts of screens to approximate potential reductions for target organisms to help evaluate their feasibility. Unfortunately, the analysis revealed that the screen technologies would be much less effective in reducing impingement and entrainment than initially identified in Phase I assessment.[17] The results of the Tenera Study are presented in the Table 1 below.

Table 1. Tenera Study Results – Average Percent Reduction in Mortality

Slot Size	0.75 mm	1 mm	2 mm	3 mm	4 mm	5 mm
Average Percent Reduction	53.7 %	39.7 %	8.4 %	1.0 %	0.1 %	0.0 %

The Tenera report, which was based on the results of head capture analysis, indicated that mesh or slot openings larger than about 3 mm would result in very little reduction in population-level mortality.[18] For Diablo Canyon, Bechtel concluded that there is very little reduction in entrainment for any mesh or slot openings larger than about 1mm due to the generally smaller size of the larvae entrained there. Bechtel viewed this as a significant shortcoming for the screen alternatives.

The construction of the tunnel for water conveyance for the wedge wire screen option will pose major construction impacts, which appear to be the biggest potential environmental impact. There would be significant spoils from the excavation that would have to be put somewhere (the specific amount or where it would be placed is not identified in the report).

The placement of the wedge wire screens may require temporary offshore platforms or barges and may cause localized turbidity impacts from disruption of the local sea bed. Assessing the balance of the wedge wire system construction impacts to the sensitive and productive marine habitats versus its ability to further reduce impingement impacts

[17] *Length-Specific Probabilities of Screen Entrainment of Larval Fishes Based on Head Capsule Measurements, In support of California State Water Resources Control Board Once-Through Cooling Policy for Nuclear Fueled Power Plant Special Studies*, Tenera Environmental, Revised July 31, 2013.
[18] A short-coming of the analysis is that there are no water column data for the environment offshore of Diablo Canyon where the wedge wire screens would be located.

will address one of the primary environmental concerns. The placement of the fine mesh screens may result in minor onshore environmental impacts during construction.

Closed Cycle Cooling Towers

Design Considerations

Bechtel evaluated five alternative closed cycle cooling systems including:

- Passive draft dry/air cooling would require four metal hyperbolic towers approximately 590 feet in diameter and 590 feet high.
- Mechanical (forced) draft dry/air cooling would require four towers approximately 1,200 feet long, 100 feet wide, and 100 feet high.
- Wet natural draft cooling requires two hyperbolic natural draft towers approximately 590 feet in diameter and 590 feet high.
- Wet mechanical (forced) draft cooling would require two circular concrete cooling towers approximately 542 feet in diameter and 180 feet high.
- Hybrid wet/dry cooling would require two circular concrete towers similar to the wet mechanical (forced) draft cooling towers approximately 576 feet high and 180 feet in diameter.

Bechtel found that dry cooling technologies require minimal make-up water to account for system leaks/losses once the system is initially charged and would not require as much land as the wet cooling alternatives. Wet cooling technologies for Diablo Canyon would require 33,100 GPM of make-up water to compensate for evaporation, blowdown, and drift losses. Make-up water could be obtained from a combination of a new on-site desalination plant and processed reclaimed water obtained from the surrounding communities. Bechtel notes that to access local wastewater sources would require at least 20 miles of new pipeline for each source. However, even before the current water crisis, the City of Morro Bay and San Luis Obispo admitted that they have very limited waste water that could be used and appear unlikely to commit water supplies for Diablo Canyon.[19]

One of the more costly aspects identified in the evaluation of the closed cycle cooling systems was Bechtel's determination that there was insufficient area within the existing

[19] Letter from Rob Livick, PE/PLS, Public Services Director/City Engineer, City of Morro Bay, to Review Committee for Nuclear Fueled Power Plans, October 22, 2013. Letter from Carrie Mattingly, Utilities Director, City of San Luis Obispo, to Review Committee for Nuclear Fueled Power Plants, October 9, 2013.

power plants footprint to accommodate cooling towers.[20] As a result, they determined that the mountain immediately north of the plant power block would need to be leveled to 115 feet to accommodate major structures such as towers, a new pump house, and a desalination plant. The leveled area required would be approximately 62 acres for two cooling towers and 109 acres for four cooling towers. The excavation quantities for the two-tower option would be 190 million cubic yards, while the four-tower option would be 317 million cubic feet. [21]

The DCISC concluded that Bechtel's assessment that no LAR would be needed for the various closed cycle cooling options is incorrect, noting the very extensive modifications that have the potential to affect the operability of the safety-related system both during and following construction. The DCISC concludes that potential undesirable interactions of major modifications would require a detailed design review by NRC.

Potential Environmental Impacts

Bechtel identified potentially significant visual impacts from the cooling towers, biological impacts to upland and riparian habitats, and land use issues associated with the closed cycle cooling options. The air-cooled towers would have no visible plume, while the wet cooling towers would generate visually intrusive, unabated plumes. Bechtel suggests that the lower profile plume abated hybrid wet/dry cooling towers could mitigate some visual concerns. Fugitive dust from earthwork and concrete activities associated with construction of the cooling towers is expected to be significant. Potentially significant diesel and gasoline engine air emissions are also expected during construction.

For towers using fresh or reclaimed water, no potential air quality issues were identified beyond those during construction. However, Bechtel concluded, based on previous studies, that a saltwater wet cooling system would generate PM-10 in excess of the emission reduction credits available in the San Luis Obispo Air Pollution Control District.

Bechtel Cost Estimates for Alternatives to OTC

Bechtel presents cost estimates for the alternative technologies based on their proprietary estimating process, which includes costs from other power plants, capital improvements, and engineering projects, as well as requesting cost bids from suppliers. Bechtel also provides estimated schedules for total permitting and construction period for the various options.

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[20] FOE notes that Bechtel budgets $3.3 billion primarily to remove the mountain to make space for the cooling towers and desalination plant.

[21] For comparison purposes, the construction of the Panama Canal required the excavation of about 200 million cubic feet of material. http://en.wikipedia.org/wiki/Panama_Canal

FOE filed a letter on November 21, 2013 stating that: "Bechtel cost estimate is not credible due in substantial part to the selection of a steep and cost-prohibitive site chosen for the cooling towers."[22] FOE argued that a saltwater cooling tower located in the south parking lot area would result in much lower costs, citing previous studies that had concluded that there was sufficient space for cooling towers. In addition, FOE argued that Bechtel had eliminated salt water cooling, premised on the faulty assumption that PM-10 credits would not be available. The Review Committee requested that the Water Board staff work with FOE and Bechtel to specify a lower cost option for saltwater closed cooling system located on the southern portion of the existing plants site. The Review Committee also requested that the Water Board staff contact the San Luis Obispo Air Quality Management District regarding the availability of PM-10 offset credits. The Subcommittee finds no basis for excluding the salt water cooling from further consideration.

The cost and schedules prepared by Bechtel are presented in Table 2 below.

Table 2. Summary of Technology Cost and Schedule[23]

Technology	Cost in Millions	Schedule Duration in Years
Closed Cycle Cooling		
Mechanical (Forced) Draft Dry/Air Cooling	**$10,200 - $14,134**	**13**
Passive Draft Dry Air Cooling	**$10,104 - $14,045**	**13**
Wet Mechanical (Forced) Draft Cooling	**$8,567 -$11,647**	**14**
Wet Natural Draft Cooling	**$10,185 - $14,112**	**14**
Hybrid Wet/Dry Cooling	**$8,654 - $11,723**	**13**
Salt Water Wet Mechanical Cooling[24]	**$7,483 - $7, 505**	
Screen Technologies		
Onshore Mechanical Fine Mesh Screening	**$346 - $438**	**8**
Offshore Modular Wedge Wire Screening	**$456 - $602**	**10**

[22] *Comments on September 2013 Bechtel Phase 2 Final Technologies Assessment for Alternative Cooling Technologies at Diablo Canyon Power Plants*, November 18, 2013, Dr. Peter Henderson and Dr. Richard Seaby, PISCES Conservation Ltd, Lymington, England and Bill Powers, P.E., Powers Engineering, San Diego, California, p. 13.
[23] *Alternative Cooling Technologies or Modifications to the Existing Once-Through Cooling System for the Diablo Canyon Power Plant (Draft)*. Bechtel Power Corporation, December 13, 2013, p. 8
[24] Cost estimates for the salt water cooling system are presented in the Bechtel Draft Addendum, which has not yet been publicly released. *Draft Addendum to Alternative Cooling Technologies or Modifications to the Existing Once Through Cooling System*, July 2, 2014, Table 6.3-2 and 6.6-3, p.37-38.

The closed cycle cooling options, which will fully meet the OTC Policy, range from a low of $7,483 million for salt water cooling to a high of $14,134 for passive draft dry air cooling. The costs for the screen technologies, while substantially lower than costs of closed cycle cooling would not achieve the impingement and entrainment reductions at Diablo Canyon and as a result should not be considered a viable alternative to OTC.

Comparison of Cost Estimates for Wet Cooling Towers

FOE provided cost estimates from two additional studies on the cost of the closed cycle wet cooling option on the existing power plant footprint. This provided a comparison of Bechtel's cost estimates with other studies as shown in Table 3 below.[25] The PG&E cost estimates are about half the Bechtel estimate, while the TetraTech estimates are about 1/6 the estimates prepared by Bechtel. At a minimum, the disparity in the different cost estimates is a good indicator of the high level of uncertainty about project costs.

Table 3. Comparison of Cooling Tower Cost Elements

Technology	Bechtel[26] ($ millions)	PG&E ($ millions)	TetraTech ($ millions)
1) Site Work, Excavation, Retaining Walls	3,632	325	213
2) Demolition, replacement (buildings, roads, etc.)	N/A	316	219
3) Recirculating/make-up water pumps, tunnels, etc.	506	298	
4) Permitting, engineering, management, security	370	269	See #11
5) Cooling towers	272	242	61
6) Electrical systems, process/instrumentation, etc.	133	199	16
7) Worker transport, commute wages, parking	21	189	N/A
8) Upgrades – condensers, sewage treatment, SCW	See #2	131	26
9) Blowdown water treatment, mixing station, diffuser	See #2	56	See #3
10) Plant shutdown and start-up	N/A	56	N/A
11) Indirect costs and contingency	3,480	614	360
Total Construction Costs	8,414	2,689	895
Replacement Power Costs	1,493	614	360
TOTAL PROJECT COST	9,907	4,489	1,622

[25] *Comments on September 2013 Bechtel Phase 2 Final Technologies Assessment for Alternative Cooling Technologies at Diablo Canyon Power Plants*, November 18, 2013, Dr. Peter Henderson and Dr. Richard Seaby, PISCES Conservation Ltd, Lymington, England and Bill Powers, P.E., Powers Engineering, San Diego, California. p. 25-26.

[26] The Bechtel estimates used by FOE in this comparison were early estimates from the September 20, 2013 Draft Report that were subsequently increased in the Draft Final Report.

In developing cost estimates, it appears that achieving cost savings in designing alternatives was not one of the criteria Bechtel used. This may explain to some degree the much larger Bechtel cost estimates when compared with previous studies. Bechtel described how they used "accepted guidelines and criteria" during the study "to identify the *best technical location without regard to cost* to site cooling towers for the closed cycle cooling options."[27] Bechtel also concluded that the "southern area is not the *optimal* location for the tower."[28] Another of Bechtel's criteria for the placement of towers was "proper spacing to obtain *best performance*." From these examples it appears that Bechtel's estimates are based on designs that reflect ideal conditions. In reality, retrofitting an existing site not originally designed for the retrofit is by definition anything but ideal. It seems reasonable to assume that some level of cost reduction could be achieved for the different options without risking the safety and reliability of the plant. One sure way to determine costs would be for PG&E to conduct a competitive bid for the project with appropriate risk management and performance terms as determined with concurrence by the CPUC.

Other Considerations Affecting Diablo Canyon

The Water Board should be aware that the question of whether PG&E moves forward with retrofitting Diablo Canyon to comply with the OTC Policy is part of a larger discussion regarding relicensing of the facility. Some will argue that the cost of compliance with the OTC Policy is so great that Diablo Canyon should be exempted from the OTC policy altogether, suggesting that a decision by the Water Board to require Diablo Canyon to comply with the same requirements as the other OTC power plants in California will make it cost-prohibitive to operate Diablo Canyon beyond its current licenses. Some parties, such as NRDC, believe that it is essential that the nuclear plants comply with the OTC policy and that the Bechtel study not be used to develop an explanation as to why Diablo Canyon cannot comply.[29] Others, such as A4NR, will argue for retirement timed with the expiration of the current licenses, not just because of the costs for OTC compliance but for a number of other issues that will affect Diablo Canyon, largely associated with seismic issues.

Ultimately, the decision about retrofitting Diablo Canyon with closed cycle cooling will be part of the relicensing decision made by the CPUC and the NRC. The CPUC recently identified a number of issues that must be addressed by PG&E prior to seeking any

[27] Handout from December 18, 2013 Review Committee Meeting entitled *Bechtel – Cooling Tower Location*. See http://www.swrcb.ca.gov/water_issues/programs/ocean/cwa316/rcnfpp
[28] Ibid.
[29] Letter from NRDC to Review Committee for Nuclear Fueled Power Plants RE: Comments on the Final Interim Technical Assessment Report for SONGS and Diablo Canyon Nuclear Power Plants, January 23, 2013.

requests for ratepayer funding of relicensing activities.[30] Diablo Canyon is nearing its fourth decade of operation and as an aging nuclear facility faces a number of challenges. Several nuclear plants in the U.S., including the SONGS, are being retired early some for purely economic reasons and others based on excessive costs of repair.[31] Aging plants face increasing non-fuel O&M costs, greater risk of outages, which across the nation have become more frequent and of longer duration, and competition from lower cost, less risky alternatives. In addition, over the years concerns have been raised over Diablo Canyon's potential vulnerability to seismic events. There are seismic issues including the hazards posed by multiple fault zones (and their interconnectivity) within the vicinity of Diablo Canyon including the Hosgri, Shoreline, San Luis Bay, Los Osos and Irish Hills zones of faulting and the possibility of an earthquake directly beneath the plant. The CPUC intends to do a thorough evaluation of the overall economic and environmental costs and benefits of a license extension for Diablo Canyon including seismic issues.

Conclusions

The Subcommittee finds that there is no basis for an exemption for Diablo Canyon from the OTC Policy. Based on the information presented above, the closed cycle cooling options are viable alternatives to OTC for Diablo Canyon and should be considered with other viable cooling options. While the costs for closed cycle cooling are highly uncertain, there is no doubt about the viability of closed cycle cooling in meeting the OTC policy. As a consequence, Diablo Canyon should be required to meet the same standards set forth in the OTC Policy for the other OTC plants under Track 1.[32] It appears that salt water mechanical draft cooling located on the existing footprint of the plant presents the least costly alternative. However, there are significant logistical challenges that will need to be overcome for any of the closed cycle cooling options.

[30] Letter from Michael R. Peevey, President CPUC, to Christopher Johns, President of PG&E, February 19, 2014.
[31] See: http://www.nytimes.com/2013/06/15/business/energy-environment/aging-nuclear-plants-are-closing-but-for-economic-reasons.html; http://thebulletin.org/nuclear-aging-not-so-graceful; http://www.nytimes.com/2012/10/24/business/energy-environment/economics-forcing-some-nuclear-plants-into-retirement.html.
[32] Track 1 of the OTC Policy requires an owner or operator of an existing power plant to reduce the intake flow rate at each unit, at a minimum, to a level commensurate with that which can be attained by a closed cycle cooling system. OTC Policy, Section 2.A (1).