

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION

William M. Dean, Director

In the Matter of	)	Docket Nos. 50-275 and 50-323
	)	
Pacific Gas and Electric Company	)	License Nos. DPR-80 and DPR-82
	)	
Diablo Canyon Power Plant	)	
Units 1 and 2	)	

**DIRECTOR'S DECISION UNDER 10 CFR 2.206**

**I. Introduction**

On August 26, 2014, Friends of the Earth (FOE or the petitioner) filed a Petition to Intervene and Request for Hearing (Petition)<sup>1</sup> concerning Diablo Canyon Power Plant, Units 1 and 2 (DCPP). In this Petition, FOE claims that DCPP is violating its licensing basis, and therefore the plant's operational safety and its ability to safely shut down in the event of an earthquake caused by nearby faults is in question. The petitioner requested that the U.S. Nuclear Regulatory Commission (NRC or Commission) take enforcement actions to ensure that DCPP can operate safely and demonstrate its ability to safely shut down in the event of an earthquake caused by nearby faults. As the basis for the request, the petitioner states that the "NRC staff's determination that the new seismic information, including the Shoreline earthquake and its effect on the San Luis Bay and Los Osos faults, is a lesser-included case within the

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML14254A231.

Hosgri earthquake is insufficient to insure that Diablo Canyon is operating safely with an adequate margin of safety.”<sup>2</sup>

The Commission, by a memorandum and order (CLI-15-14) dated May 21, 2015,<sup>3</sup> referred those concerns to the NRC’s Executive Director for Operations (EDO) for consideration under Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.206, “Requests for action under this subpart.” Therefore, the NRC staff treated these concerns in FOE’s hearing request as a petition for enforcement action pursuant to 10 CFR 2.206.

On two occasions, the NRC offered FOE opportunities to address the Petition Review Board (PRB), which was established to review FOE’s enforcement concerns. In response, on September 30, 2015, and February 8, 2016,<sup>4</sup> FOE provided written submissions to the PRB in lieu of addressing the PRB in person or by telephone. The NRC staff considered these submittals during its evaluation.

In a letter dated April 12, 2016,<sup>5</sup> the NRC informed FOE that its concerns met the criteria for acceptance for consideration provided in Management Directive (MD) 8.11, “Review Process for 10 CFR 2.206 Petitions,” dated October 25, 2000,<sup>6</sup> and that the NRC had referred the petition to the Office of Nuclear Reactor Regulation and the Office of New Reactors for appropriate action.

By letters to the petitioner and the Pacific Gas and Electric Company (PG&E, the licensee) dated February 28, 2017,<sup>7</sup> the NRC issued the proposed Director’s Decision<sup>8</sup> for comment. The NRC staff did not receive comments from the petitioner or the licensee.

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<sup>2</sup> Page 47 of the Petition.

<sup>3</sup> ADAMS Accession No. ML15141A084.

<sup>4</sup> ADAMS Accession Nos. ML15274A054 and ML16040A221, respectively.

<sup>5</sup> ADAMS Accession No. ML16084A717.

<sup>6</sup> ADAMS Accession No. ML041770328.

<sup>7</sup> ADAMS Accession Nos. ML17011A205 and ML17011A206, respectively

<sup>8</sup> ADAMS Accession No. ML17011A204

## II. Discussion

Under 10 CFR 2.206(b), the director of the NRC office with responsibility for the subject matter shall either institute the requested proceeding to modify, suspend, or revoke a license, or advise the person who made the request in writing that no proceeding will be instituted, in whole or in part, with respect to the request and the reason for the decision. The petitioner raised concerns about violations of DCP's licensing basis, operational safety, and ability to safely shut down in the event of an earthquake associated with the Shoreline, San Luis Bay, or Los Osos faults.

At the time that FOE submitted this Petition in August 2014, the NRC staff had dispositioned a Differing Professional Opinion (DPO) on seismic concerns at DCP. A publicly available Case File, DPO-2013-002,<sup>9</sup> provides the concerns submitted by an NRC employee and former resident inspector, Dr. Michael Peck, on the topic of DCP seismic issues; the deliberations of an independent, three-person NRC panel assigned to assess the DPO (referred to as the DPO Panel); the initial NRC management decision based on the independent DPO Panel; the NRC employee's appeal of the initial management decision; and the review and final disposition of the appeal by the NRC's EDO. The bases for the concerns in the DPO are similar to those submitted in the Petition. In fact, the DPO submittal is used as the basis for several of the petitioner's assertions. However, as the Commission noted in CLI-15-14, the issues raised in the DPO and in FOE's Petition are not identical, and seismic reevaluation is ongoing at the DCP.<sup>10</sup>

The NRC staff analyzed FOE's enforcement concerns and the results of those analyses are discussed below. Results of the ongoing seismic reevaluation at DCP are also discussed

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<sup>9</sup> ADAMS Accession No. ML14252A743.

<sup>10</sup> Page 9 of CLI-15-14, footnote 30.

below. The decision of the Director of the Office of Nuclear Reactor Regulation is provided with respect to each of these concerns.

**Concern 1: The Hosgri Evaluation (HE) and the associated Long Term Seismic Plan (LTSP) is a weaker seismic evaluation method than the NRC's recommended method and is inadequate to demonstrate that DCPD can safely shut down following an earthquake caused by the Shoreline, San Luis Bay, or Los Osos faults.<sup>11</sup>**

The petitioner states that the NRC "...treated the Hosgri Evaluation as a 'special case,' permitting the seismic evaluation under the LTSP to use materially weaker assumptions than in the NRC standard method," and that the NRC's comparison of "...the updated ground motion levels from the three faults to the ground motion levels of the [HE] is not a sufficient basis for concluding that the plant may continue to operate with an adequate margin of safety."<sup>12</sup> FOE contends that "projected ground motion at the plant site caused by an earthquake on one of the three faults is equal to or greater than potential ground motion caused by a Hosgri earthquake."<sup>13</sup>

The DCPD Updated Final Safety Analysis Report (UFSAR) states that there are three design basis earthquakes for DCPD: (1) the design earthquake (DE, 0.2 g (gravity) peak ground acceleration (PGA)), (2) the double design earthquake (DDE, 0.4 g PGA), and (3) the Hosgri Evaluation (0.75 g PGA).<sup>14</sup> These design earthquakes were analyzed as the design basis for seismic impacts to structures, systems, and components (SSCs) at DCPD important to safety, and have been well established as the seismic design basis for DCPD since the initial operating licenses for this plant were issued. FOE's concern that the HE is not part of the

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<sup>11</sup> Page 54 of the Petition.

<sup>12</sup> Pages 9 and 49 of the Petition, respectively.

<sup>13</sup> Page 6 of the Petition.

<sup>14</sup> UFSAR, Section 3.7, "Seismic Design," on page 3.7-1 (ADAMS Accession No. ML16004A126).

DCPP licensing basis is not supported by DCPP licensing basis documents. This concern is discussed further in Concern 5 below.

FOE states that PG&E's analyses for the LTSP and HE use materially weaker assumptions and show that the potential ground motion of an earthquake on the Shoreline, San Luis Bay, or Los Osos Faults could cause ground motion at DCPP that exceeds the HE. Thus, FOE states the HE is inadequate and not a valid basis for comparison for the Shoreline fault.<sup>15</sup>

The NRC staff disagrees that the analyses used by PG&E for the LTSP and HE are inadequate for comparison to the new seismic data in the Shoreline fault because licensees are permitted to show seismic compliance using different methods of technical assessment and evaluation. Alternate evaluation methodologies to show compliance are reviewed on a case-by-case basis by the NRC staff and a determination is made as to the acceptability of the alternate methodologies and the results. FOE's assertion is similar to Dr. Peck's DPO concern that "PG&E's operability evaluation following the development of the new seismic information was inadequate, because the new seismic information was not compared correctly to the plant's licensing basis."<sup>16</sup> The DPO Panel evaluating Dr. Peck's concern recognized that different methodologies and assumptions were used in the evaluations of the DE, DDE, HE, and LTSP.<sup>17</sup> The NRC found the use of an alternate methodology acceptable in the Shoreline analyses, as alternative approaches were used previously in the UFSAR and LTSP to analyze potential ground motions. The DPO Panel also stated that use of alternate methodologies are technically

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<sup>15</sup> Pages 6 and 20 of the Petition, page 4 of FOE's supplement dated September 30, 2015, and page 2-3 of FOE's supplement dated February 8, 2016; see also pages 20-24 of FOE's Reply to NRC Staff's and PG&E's Answers and Proposed *Amicus Curiae* Nuclear Energy Institute's Brief in Response to Petition (ADAMS Accession No. ML14287A788).

<sup>16</sup> DPO Panel Report, Section 3, "Statements of Concerns," starting on Adobe portable document format (PDF) page 56 of the DPO Case File.

<sup>17</sup> DPO Panel Report, Section 2.1, "Use of Seismic Ground Motions in Safety Analyses," starting on PDF page 54 of the DPO Case File.

acceptable and consistent, as summarized in DPO Panel Report, Section 4.2, "Evaluation of Specific DPO Concerns."

The DPO Panel identified that certain comparisons between the Shoreline evaluation<sup>18</sup> and information in the DCPD UFSAR<sup>19</sup> did not take into account the differences in assumptions for the two analyses.<sup>20</sup> The DPO Panel also recognized the challenge of comparing new seismic information and existing information, and questioned whether it was appropriate to compare the two since the ground motions are different relative to the use of free-field response spectra and damping values.<sup>21</sup>

Ultimately, the DPO Panel concluded that the NRC properly evaluated the licensee's determination of operability as presented in Prompt Operability Assessment of October 21, 2011.<sup>22</sup> However, the DPO Panel also determined that additional information from the licensee would be useful to allow a direct comparison of potential ground motions in the Shoreline report to the ground motions used in the UFSAR analyses.<sup>23</sup> PG&E agreed to conduct additional analyses of the new ground motions, so that the results of these analyses would be directly comparable to the inputs used in the UFSAR analyses.<sup>24</sup> The Panel reviewed the additional calculations that were developed by PG&E and found that potential ground motions from the Shoreline report generally do not exceed the levels of in-structure acceleration already considered during the design and licensing of DCPD.<sup>25</sup> The DPO Panel acknowledged that

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<sup>18</sup> Chapter 6.0, "Seismic Hazards Analysis," starting on page 6-1 (ADAMS Package Accession No. ML110140431).

<sup>19</sup> UFSAR, Section 3.7, "Seismic Design" on page 3.7-1.

<sup>20</sup> DPO Panel Report, Section 4.2.1, "Technical Assessment of the Potential for Seismic Loads on SSCs to Exceed Previously Analyzed Conditions," on starting on PDF page 60 of the DPO Case File.

<sup>21</sup> *Id.*

<sup>22</sup> DPO Panel Report, Section 4.2, "Evaluation of Specific DPO Concerns," on PDF page 58 of the DPO Case File.

<sup>23</sup> DPO Panel Report, Section 4.2.1, on PDF page 61 of the DPO Case File.

<sup>24</sup> *Id.*

<sup>25</sup> *Id.*

using the ergodic evaluation method resulted in some SSCs' "...response spectra met or slightly (<10%) exceeded the DDE+HE spectrum at spectral frequencies of 30-50 Hz [Hertz]. This small high-frequency exceedance would not be expected to significantly affect the performance of these types of SSCs. In addition, most of the slight exceedances occurred for SSCs that PG&E had selected a conservative damping value (i.e., lower than used for HE analyses)."<sup>26</sup> Thus, the HE is considered the bounding seismic licensing basis because the exceedances are small and within the acceptable range considering the conservative margins inherent in the DCPD analysis. Therefore, the NRC staff determined that the HE is appropriate as the bounding seismic design basis evaluation and, thus, DCPD is safe to continue operating.

In summary, the DPO Panel acknowledged that different methodologies were used when new seismic information came to light to demonstrate that DCPD is safe to operate, but that these alternate methodologies are adequate and acceptable for demonstrating that DCPD is safe to operate. The DPO Panel took additional action by requesting information from PG&E to directly compare the potential ground motions from the faults – Shoreline, San Luis Bay and Los Osos – with the seismic licensing basis (DE, DDE, and HE). The DPO Panel ultimately found that the potential ground motions from the Shoreline report generally do not exceed the levels previously considered. Thus, FOE's concern about the adequacy of the LTSP and HE has been reviewed and dispositioned by the NRC staff through the DPO process. Moreover, FOE's concern that the use of the HE is inadequate for comparison with the Shoreline report has been resolved by the NRC staff through the DPO process. Finally, FOE's concern about the operability of DCPD's SSCs considering the exceedances of the Shoreline report over the HE have been reviewed and resolved by the NRC staff through the DPO process.

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<sup>26</sup> DPO Panel Report, Section 4.2.1, on PDF page 62 of the DPO Case File.

For the reasons set forth above, the NRC staff determines that DCPD is safe to continue operating and is able to safely shut down following an earthquake caused by the Shoreline, San Luis Bay, or Los Osos faults. Therefore, the NRC staff does not have a basis for expanding its current level of regulatory oversight in accordance with the NRC's Reactor Oversight Process and the Enforcement Policy, or otherwise taking the petitioner's requested enforcement actions against the licensee.

**Concern 2: The NRC's own policy does not permit PG&E to determine that the plant is safe to continue operating based on the probabilistic risk assessment ordered by the NRC.<sup>27</sup>**

The petitioner states that "[i]n response to the [Near Term] Task Force's<sup>28</sup> [NTTF] recommendations, the NRC Staff requested that PG&E develop new probabilistic ground motion models. The results of these models were then to be compared to [DCPD's] existing SSE [safe-shutdown earthquake (SSE), equivalent to DDE], which is deterministic in nature. But given that Diablo Canyon's design bases are deterministic in nature, a probabilistic risk assessment cannot be used to determine compliance with the plant's design bases."<sup>29</sup>

As a result of the NTTF review of insights from the Fukushima Dai-ichi accident,<sup>30</sup> the Commission instructed the NRC staff, in Staff Requirements Memoranda associated with SECY-11-0124 and SECY-11-0137,<sup>31</sup> to issue a letter instructing licensees to perform seismic hazard reevaluations at each site against present-day NRC requirements and guidance. As the state of knowledge of natural phenomena hazards has evolved significantly since the licensing

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<sup>27</sup> Page 58 of the Petition.

<sup>28</sup> NTTF is a task force established by the NRC in response to the 2011 accident at the Fukushima Daiichi nuclear power plant in Japan.

<sup>29</sup> Page 58 of the Petition.

<sup>30</sup> ADAMS Accession No. ML111861807.

<sup>31</sup> ADAMS Package Accession Nos. ML11245A158 and ML11272A111, respectively.



of many of the nuclear power plants within the U.S., and given the demonstrated consequences from Fukushima, the Commission determined that it was necessary to confirm the appropriateness of the hazards assumed for U.S. plants and each plant's ability to protect against them.

In response to these instructions, the NRC staff issued a request for information pursuant to 10 CFR 50.54(f) (referred to as the 10 CFR 50.54(f) letter), dated March 12, 2012,<sup>32</sup> to all nuclear power plant licensees to allow the NRC staff to determine whether additional regulatory action was needed in the areas of seismic and flooding design and emergency preparedness. The 50.54(f) letter included a specific request associated with NTF Recommendation 2.1 for seismic hazard reevaluations.<sup>33</sup> The 50.54(f) letter specified a two-phase implementation for the seismic hazard: (1) request all operating reactor licensees to reevaluate the seismic hazard at their sites using updated seismic hazard information and present-day regulatory guidance and methodologies and, if necessary, to perform a risk evaluation, and (2) if necessary, based upon the results of Phase 1, NRC staff determined whether additional regulatory actions are necessary (e.g., update the design basis and SSCs important to safety) to protect against the updated hazards.<sup>34</sup>

As discussed in Enclosure 1 to the 50.54(f) letter, the NRC staff recognized that the design bases for nuclear power plants were either developed in accordance with, or meet the intent of, 10 CFR Part 50 Appendix A, General Design Criterion (GDC) 2, "Design bases for protection against natural phenomena," and 10 CFR Part 100, Appendix A, "Seismic and Geologic Criteria for Nuclear Power Plants."<sup>35</sup> Although the regulatory requirements in 10 CFR Part 100, Appendix A are fundamentally deterministic, the NRC process for determining the

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<sup>32</sup> ADAMS Accession No. ML12053A340.

<sup>33</sup> 50.54(f) letter, Enclosure 1, "Recommendation 2.1: Seismic."

<sup>34</sup> 50.54(f) letter, Enclosure 1, on page 4.

<sup>35</sup> *Id.*

seismic design basis ground motions for new reactor applications on or after January 10, 1997, as described in 10 CFR 100.23, "Geological and Seismic Siting Criteria," uses a probabilistic seismic hazard analysis. All currently operating U.S. nuclear power plants, including DCP, used deterministic criteria for their seismic design; that is, licensees used historical seismic activity known at the time at the site and surrounding area. The design bases used the most severe seismic activity historically reported with margin to account for the limited accuracy.

As part of the 50.54(f) letter, the NRC staff communicated that the state of knowledge of seismic hazards has evolved and the level of conservatism in the assessment of the original deterministic seismic design bases needed to be reexamined.<sup>36</sup> The NRC staff further stated that licensees need to use a probabilistic approach in order to develop a risk-informed performance-based ground motion response spectrum (GMRS) for the site, as provided in Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," dated March 2007.<sup>37</sup> The probabilistic assessment approach represents the state-of-the-art hazard determination and provides a comprehensive approach for estimating earthquake hazards. Thus, the NRC staff recognized and endorsed the use of the more modern and advanced methods of seismic hazard assessments using risk. The NRC staff held over 15 public meetings over a 9-month period with stakeholders to develop the guidance that the industry would use to compare risk and deterministic information. The NRC staff addressed the comparison of the risk-based reevaluation to the deterministic-based seismic design, and used its expertise to develop a logical, systematic, and conservative process<sup>38</sup> to ensure the industry could make these comparisons appropriately and consistently.

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<sup>36</sup> 50.54(f) letter, Enclosure 1 on pages 1-2.

<sup>37</sup> ADAMS Accession No. ML070310619.

<sup>38</sup> All licensees committed to follow the guidance of the Electric Power Research Institute (EPRI) Report, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," dated November 2012, found at

As a result, the NRC developed guidance for the nuclear power industry to apply consistently in comparing the new seismic hazard based on risk to the existing deterministic seismic design basis.

In response to the 10 CFR 50.54(f) letter, NRC staff reviewed the new seismic hazard analyses completed by all the sites and made determinations as to the acceptability of these comparisons.<sup>39</sup> PG&E provided its new seismic hazard analyses, called the Seismic Hazard and Screening Report, for the DCPD site by letter dated March 11, 2015.<sup>40</sup> The licensee's report concluded that the GMRS exceeds the DDE (i.e., the SSE) within the frequency range of 1 Hz to 10 Hz.<sup>41</sup> Therefore, in accordance with Phase 1 of the 10 CFR 50.54(f) letter, PG&E needed to perform a seismic probabilistic risk evaluation. In addition, the licensee needed to complete a high frequency confirmation because the GMRS also exceeds the SSE above 10 Hz. While PG&E needed to perform additional analyses, the NRC stated that PG&E demonstrated that the seismic margins are supportive of continued plant operation while additional risk evaluations are conducted.<sup>42</sup>

As a result, PG&E is in the process of conducting its seismic probabilistic risk evaluation for DCPD. The NRC staff currently expects to receive the results of this evaluation by September 30, 2017. Upon receipt, the NRC will review PG&E's seismic risk evaluation to

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ADAMS Accession No. ML12333A170. The NRC staff's endorsement letter dated February 15, 2013, is found at ADAMS Accession No. ML12319A074.

<sup>39</sup> On May 13 and October 27, 2015 (ADAMS Accession Nos. ML15113B344 and ML15194A015, respectively), the NRC staff issued letters providing the outcome of its screening and prioritization evaluation for Western United States (WUS) plants (WUS screening letters). As indicated in the letters, the NRC staff confirmed the licensees' screening results and examined key parameters to prioritize plants for completion of the seismic risk evaluations. In a letter to PG&E dated December 21, 2016 (ADAMS Accession No. ML16341C057), the NRC staff concluded that "the licensee [PG&E] conducted the seismic hazard reevaluation using present-day methodologies and regulatory guidance, it appropriately characterized the DCPD site given the information available, and met the intent of the guidance for determining the reevaluated seismic hazard."

<sup>40</sup> ADAMS Package Accession No. ML15071A046.

<sup>41</sup> PG&E's Seismic Hazard and Screening Report, Enclosure 1 on page 46.

<sup>42</sup> Page 2 of WUS screening letter dated May 13, 2015.

determine whether key plant systems and components can withstand the higher ground motions associated with the reevaluated hazard at DCP. If it is determined that the plant systems and components cannot adequately withstand the higher ground motion, the NRC will take additional regulatory action, in accordance with Phase 2 of the 50.54(f) letter.

The petitioner's concern also involves the relationship between plant operability and the reevaluated hazards.<sup>43</sup> The NRC issued a letter dated February 20, 2014,<sup>44</sup> to all power reactor licensees, which included supplemental information regarding the seismic hazard reevaluations associated with the 50.54(f) letter. The NRC staff clarified that the seismic hazard reevaluations being performed pursuant to the 50.54(f) letter are distinct from the current design or licensing basis of operating plants.<sup>45</sup> Consequently, the results of the analysis performed using present-day regulatory guidance, methodologies, and information would not generally be expected to call into question the operability or functionality of SSCs. However, as with any new information that may arise at a plant, licensees are responsible for evaluating and making determinations related to operability. If at any time during completion of these seismic reevaluations, the NRC determines that new seismic information reveals vulnerabilities in the current seismic design basis, it will take appropriate additional regulatory action. In this case, the NRC determined DCP acted appropriately and within the guidance endorsed by the NRC staff in evaluating the new seismic information at DCP. Further, the NRC staff reviewed the DCP hazard information and made an independent assessment that the evaluation was adequate and that DCP is safe to continue operating.

The petitioner also raises a concern regarding the guidelines used for analyzing newly discovered seismic data at DCP. Specifically, the petitioner states that "Diablo Canyon's

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<sup>43</sup> Pages 58 and 59 of the Petition.

<sup>44</sup> ADAMS Accession No. ML14030A046.

<sup>45</sup> Page 2 of the letter dated February 20, 2014.

operating license contains no clear direction or guidelines regarding how PG&E is required to analyze newly discovered seismic data.<sup>46</sup> Similarly, Dr. Peck raised a concern in his DPO about his perceived lack of direction for PG&E in assessing the new seismic data at DCPD.<sup>47</sup> The DPO Panel determined that the ongoing efforts to address lessons learned from the Fukushima Dai-ichi accident provide the appropriate regulatory framework to address this concern, as discussed in Section 4.2 of the DPO Panel Report.

As part of these ongoing efforts, the NRC staff has enhanced its current processes for addressing changes in external hazard information. The Fukushima lessons-learned efforts also led to installing additional safety enhancements to bolster plants' ability to withstand extreme natural events beyond the facilities' current design basis. Specifically, the NRC staff is in the process of codifying, through rulemaking, a requirement that licensees provide capabilities to mitigate the beyond-design-basis flood and seismic events identified through the hazard reevaluations. As contemplated in the draft final rule, operating power reactor licensees would be required to maintain this capability in a manner similar to other beyond-design-basis events (e.g., station blackout, and loss of large areas of the plant caused by explosions or fire) to ensure added assurance of protections against severe natural events such as earthquakes. The NRC staff provided the draft final rule to the Commission in SECY-16-0142, "Draft Final Rule-Mitigation of Beyond-Design-Basis Events (RIN 3150-AJ49)."<sup>48</sup> While this proposed regulation is still in the midst of NRC's rulemaking process, and thus does not constitute a final agency action, the NRC staff and the Commission have nevertheless determined that all U.S. nuclear power plants, including DCPD, are currently safe to operate.<sup>49</sup>

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<sup>46</sup> Page 9 of the Petition and as discussed in supplements dated September 30, 2015, and February 8, 2016.

<sup>47</sup> Summarized on PDF page 56 of the DPO Case File.

<sup>48</sup> ADAMS Package Accession No. ML16301A005.

<sup>49</sup> Stated in NTF Report July 12, 2011, SECY-11-0093 ADAMS Accession No. ML111861807; restated in request for information dated March 12, 2012, cover letter, page 1.

In summary, PG&E acted appropriately and within the parameters specified by the NRC staff in its 50.54(f) letter when evaluating the new seismic hazards at the DCP. The NRC staff completed a thorough and in-depth evaluation of DCP's reevaluated seismic hazard information it has received to date (discussed in more detail in Concern 3 below) in response to the 50.54(f) letter, and it has determined that DCP is safe to continue operating and is able to safely shut down if it experiences a seismic event. Additionally, the NRC staff has taken appropriate actions to address the new information that resulted from seismic hazard reevaluations performed by licensees in response to the 50.54(f) letter. Therefore, the NRC staff does not have a basis for expanding its current level of regulatory oversight in accordance with the NRC's Reactor Oversight Process and the Enforcement Policy, or otherwise taking the petitioner's requested enforcement actions against the licensee.

**Concern 3: The U.S. Geological Survey (USGS) geophysicist who discovered the Shoreline fault has published research concluding that the NRC staff underestimated the capability of the Shoreline fault and the risk it poses to DCP.<sup>50</sup>**

The petitioner states that according to USGS geophysicist Dr. Jeanne Hardebeck, "the Shoreline and Hosgri faults are connected, and that a rupture on one fault could travel to the other, leading to a much larger earthquake than would be possible on a single, independent fault."<sup>51</sup> FOE quotes Dr. Hardebeck's conclusions that "PG&E and NRC would be wrong to rule out the possibility of a joint rupture . . ." that ". . . could extend the rupture length an additional ~100 km [kilometers]" and that "[t]his hypothetical earthquake would have a moment magnitude

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<sup>50</sup> Page 59 of the Petition.

<sup>51</sup> Pages 59-60 of the Petition; *see also* pages 19-20 of FOE's Reply to NRC Staff's and PG&E's Answers and Proposed *Amicus Curiae* Nuclear Energy Institute's Brief in Response to Petition.

of 7.2-7.5...”<sup>52</sup> FOE further states that the “existing study of the Shoreline Fault is not sufficient to estimate the probability of a Shoreline earthquake occurring” and quotes Dr. Hardebeck as stating that this is because the Shoreline fault “slip rate is unknown.”<sup>53</sup>

On January 7, 2011, PG&E transmitted to the NRC a report updating the local seismology in the vicinity of DCPD, titled “Report on the Analysis of the Shoreline Fault Zone, Central Coast California.”<sup>54</sup> This report included new deterministic evaluations for the Shoreline, Los Osos, and San Luis Bay earthquake faults. The licensee concluded that each of these faults was capable of producing between 0.6 g and 0.7 g PGA at DCPD. As noted under Concern 2 of this document on March 11, 2015, PG&E submitted a Seismic Hazard Screening Report for DCPD in response to NRC staff’s 50.54(f) letter, which requested that PG&E reevaluate the seismic hazard at the DCPD site using updated seismic information and present-day regulatory guidance and methodologies. PG&E’s report provided the results of a seismic hazard reevaluation using a probabilistic seismic hazard analysis as specified in 10 CFR 100.23(d) in order to develop a plant-specific GMRS for screening purposes.

By letter dated September 19, 2012, “Research Information Letter [RIL] 12-01, Confirmatory Analysis of Seismic Hazard at the Diablo Canyon Power Plant from the Shoreline Fault Zone,”<sup>55</sup> the NRC staff determined that “[t]he NRC’s conservative estimates for the potential ground motions from the Shoreline fault are at or below the ground motions for which the DCPD has been evaluated previously and demonstrated to have reasonable assurance of safety....”<sup>56</sup> RIL 12-01 evaluated the potential hazard from the Shoreline fault using traditional deterministic approaches, which generally focus on faults individually rather than consider less

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<sup>52</sup> Page 60 of the Petition.

<sup>53</sup> Id.

<sup>54</sup> ADAMS Accession No. ML110140400.

<sup>55</sup> ADAMS Accession No. ML121230035.

<sup>56</sup> Page xii of RIL 12-01.

likely earthquake rupture scenarios on linked faults. However, for its response to the 10 CFR 50.54(f) letter, PG&E developed seismic source models that considered multiple alternative earthquake rupture scenarios that involve the primary faults surrounding the DCPD site.<sup>57</sup> One of these source models specifically captures the potential for a linked rupture starting at the northernmost end of the San Andreas fault, continuing onto the San Gregorio and San Simeon faults, and then onto the Hosgri and Shoreline faults. For this rupture model, PG&E considered three maximum moment magnitudes of 7.7, 8.1, and 8.4, which correspond to theoretical earthquake rupture lengths of 221 km, 461 km, and 802 km, respectively. PG&E also developed a seismic source model that captures the potential for a simultaneous rupture of the entire Hosgri-San Simeon-San Gregorio-San Andreas fault system together with the Shoreline fault. PG&E combined these two hypothetical seismic source rupture models with multiple other source models to develop seismic hazard curves and ultimately a GMRS.<sup>58</sup>

In addition to developing multiple seismic source models, PG&E characterized the slip rates of the Hosgri, Shoreline, Los Osos, and San Luis Bay faults with emphasis on the slip rate uncertainties for the portions of these faults nearest to the DCPD site. To estimate slip rates for the primary faults, PG&E mainly relied on observed offsets of geologic features, which were developed from the extensive offshore two-dimensional and three-dimensional seismic datasets collected within the past decade. PG&E used other geological, geophysical, and geodetic data to check the reasonableness of these estimated slip rates. In particular, to estimate the slip rate for the Shoreline fault, PG&E used three geologic offset features in the San Luis Obispo Bay.<sup>59</sup>

The NRC staff reviewed the analysis developed by PG&E, and concluded in a letter dated December 21, 2016,<sup>60</sup> that the licensee used present-day guidance and methodologies to

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<sup>57</sup> See generally PG&E's Seismic Hazard and Screening Report.

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

<sup>60</sup> Pages 44-45 of NRC letter dated December 21, 2016 (ADAMS Accession No. ML16341C057).



calculate the GMRS, as requested in the 50.54(f) letter. In particular, the NRC staff concluded that the licensee reasonably captured multiple possible combinations for each of the fault rupture sources using a wide range of estimated slip rates for each of the faults near DCP, including multiple combined Shoreline/Hosgri rupture scenarios. FOE claims that as new faults have been discovered, PG&E has modified its Ground Motion Prediction Equations to obtain a desired result that reduces the margin of safety. The NRC staff disagrees because it has reviewed PG&E's analyses and determined that PG&E has consistently used the latest available peer-reviewed equations developed specifically for the WUS plants to analyze the hazard potential at DCP from the Hosgri, Shoreline, and other nearby faults.<sup>61</sup> As such, the NRC staff concluded that "the GMRS determined by the licensee adequately characterizes the reevaluated seismic hazard for the DCP site" and that "this GMRS is suitable for use in subsequent evaluations and confirmations, as needed, for the response to the 50.54(f) letter" and other actions associated with NTTF recommendations.<sup>62</sup> As stated in the WUS screening letter dated May 13, 2015, "the NRC staff review of WUS reports found that licensees have demonstrated seismic margins supportive of continued plant operation while additional risk evaluations are conducted."<sup>63</sup> The NRC concluded in the Seismic Hazard Screening Report that while DCP is conducting a seismic risk evaluation, the plant is safe to continue operation. This, in combination with the conclusion from RIL 12-01 discussed above, confirms that DCP is safe to continue operation and is capable of safe shutdown.

In summary, NRC staff concluded in a letter dated December 21, 2016, that PG&E reasonably captured multiple possible combinations for each of the fault rupture sources using a wide range of estimated slip rates for each of the faults near DCP, including multiple combined

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<sup>61</sup> Pages 44-45 of NRC letter dated December 21, 2016.

<sup>62</sup> *Id.*

<sup>63</sup> Page 2 of the WUS screening letter (ADAMS Accession No. ML15113B344).

Shoreline/Hosgri rupture scenarios. Thus, the NRC staff does not have a basis for expanding its current level of regulatory oversight in accordance with the NRC's Reactor Oversight Process and the Enforcement Policy, or otherwise taking the petitioner's requested enforcement actions against the licensee.

**Concern 4: Former NRC senior resident inspector Dr. Peck's DPO demonstrates how use of the Hosgri earthquake as a safety metric to analyze the Shoreline Fault is not sufficient to insure DCP's seismic safety.<sup>64</sup>**

In the Petition, the petitioner states that Dr. Peck's DPO provides examples of how the "NRC's proposed method of evaluating the Shoreline fault and other new seismic information is insufficient to insure plant safety."<sup>65</sup> Specifically, the petitioner states, "Dr. Peck explains that the LTSP is inadequate as an evaluation method to insure that Diablo Canyon can safely shut down."<sup>66</sup>

As discussed in Concern 1, the disposition of Dr. Peck's DPO is available to the public in Case File DPO-2013-002.<sup>67</sup> This Case File includes Dr. Peck's June 2014 appeal of the DPO Panel Report and a June 2014 Appeal Decision from NRC's EDO. Dr. Peck's primary concerns were the definition of the licensing basis for DCP, the need for a license amendment, and the requirement for enforcement action due to inappropriate actions taken by the licensee.<sup>68</sup> In his appeal, Dr. Peck stated that he agreed with the DPO Panel's conclusion with respect to the safety significance of the concerns he raised, stating, in part, "that issues raised in the DPO did not result in a significant or immediate safety concern."<sup>69</sup> Further, Dr. Peck agreed that "the

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<sup>64</sup> Page 61 of the Petition.

<sup>65</sup> Id.

<sup>66</sup> Page 62 of the Petition.

<sup>67</sup> ADAMS Accession No. ML14252A743.

<sup>68</sup> PDF page 162 of the DPO Case File.

<sup>69</sup> PDF page 87 of the DPO Case File.

potential ground motions from the nearby faults [Shoreline fault zone] would not exceed the levels of ground motion considered during licensing of the plant.”<sup>70</sup> In the Appeal Decision, the EDO agreed that the issues raised in the DPO did not result in a significant or immediate safety concern.<sup>71</sup> The EDO noted that Dr. Peck raised concerns with NRC’s licensing process, but was unable to agree with Dr. Peck’s conclusions. The DCPD seismic licensing basis topic is discussed in more detail in Concern 5 of this document.

Because the issues raised by the petitioner under this concern have been considered and resolved by the NRC staff through the DPO process, as set forth above, the NRC staff does not have a basis for expanding its current level of regulatory oversight in accordance with the NRC’s Reactor Oversight Process and the Enforcement Policy, or otherwise taking the petitioner’s requested enforcement actions against the licensee.

**Concern 5: The HE and the associated LTSP are not part of DCPD’s licensing basis and were intended to be a one-time exception to the current licensing basis.**<sup>72</sup>

The petitioner states that “[i]n approving the LTSP and its Hosgri Evaluation in the 1990s as a method to evaluate the Hosgri Fault, the NRC declined to make the LTSP part of Diablo Canyon’s licensing basis, or to designate the Hosgri Evaluation as Diablo Canyon’s bounding seismic analysis.”<sup>73</sup>

The seismic design basis for DCPD is the DE, DDE, and HE. Throughout the UFSAR, both the DDE and Hosgri earthquake are used to design and qualify SSCs that are important to safety. This basis has been well established from the time of the issuance of the operating

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<sup>70</sup> Id.

<sup>71</sup> PDF Page 163 of the DPO Case File.

<sup>72</sup> PDF Page 64 of the Petition.

<sup>73</sup> Page 69 of the Petition; *see also* page 5 of FOE’s Reply to NRC Staff’s and PG&E’s Answers and Proposed *Amicus Curiae* Nuclear Energy Institute’s Brief in Response to Petition.

license, through the LTSP evaluation, and is still the seismic design basis today as discussed in the DPO Panel Report, Section 4.1.2, "Unique Diablo Canyon Seismic Design Basis."

As stated under Concern 2 of this document, the NRC staff's requirements for the seismic design and licensing bases for currently operating power reactors are described in 10 CFR Part 50, Appendix A, GDC 2 and 10 CFR Part 100, Appendix A. In particular, 10 CFR Part 100, Appendix A, defines the licensing bases concepts of the Operating Basis Earthquake (OBE) and SSE. However, when the construction permits for DCPD were issued in 1968 and 1970, the design bases described in 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," and 10 CFR Part 100, Appendix A, were not fully implemented in their current form. As such, the Atomic Energy Commission (AEC, the NRC's regulatory predecessor) issued the DCPD construction permit with earthquake design bases of a peak horizontal ground acceleration of 0.2 g for operational-related structures (called the DE) and 0.4 g for safety-related structures (called the DDE). These seismic design criteria were based on consideration of two design-basis earthquakes: (1) a magnitude 7.25 earthquake on the Nacimiento fault 20 miles from the site, and (2) a magnitude 6.75 aftershock at the site associated with a large earthquake on the San Andreas fault. It was also concluded that there was no surface displacement hazard in the site vicinity. This conclusion was based on the absence of any displacement of the 80,000 year-old and 105,000 year-old marine terraces underlying the site area. Effectively, the DE and DDE are the DCPD functional equivalents to the OBE and SSE, respectively, as described in the current 10 CFR Part 100, Appendix A. PG&E was required to show that all equipment necessary for continued operation without undue risk to the health and safety of the public would withstand the DE/OBE (i.e., remain functional), and that all safety-related equipment needed to safely shut the plant down and maintain a safe shutdown condition would withstand the DDE/SSE.

Subsequently, during the construction phase in 1971, PG&E became aware of the Hosgri fault offshore from DCPD (based on data gathered offshore by a petroleum company), and began an evaluation of the potential hazard posed by the fault. The fault was studied in detail as part of a collaborative research program between PG&E and the USGS. The AEC, and then the NRC, worked with the USGS office to ensure that the seismic hazard was properly characterized. This effort determined that the Hosgri fault could produce up to 0.75 g ground acceleration at the DCPD site (called the HE). However, the frequency of such a large earthquake was far smaller than what is considered under the SSE requirements (i.e., unlikely to occur during the life of the plant), thus, it was categorized as an extreme event that was beyond the intent of the SSE requirements. During this study, in 1973, the AEC issued Regulatory Guide (RG) 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," dated October 1973.<sup>74</sup> RG 1.61 allowed more damping to be used in seismic evaluations than had previously been used in the evaluations of the DE and DDE. The licensee used the RG 1.61 values in the HE, but was not required to revise the dampening values it used for the DE or DDE with the differing dampening values. However, the NRC did not grant authorization to operate the plant until the additional external hazard presented by the Hosgri fault was adequately addressed. PG&E addressed the issue by demonstrating that the plant equipment needed to safely shut down the plant and maintain a safe shutdown condition could also withstand 0.75 g HE ground acceleration. This effort required reevaluation, testing, and plant modifications beyond the approved DDE seismic design bases, and provided additional margin.<sup>75</sup>

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<sup>74</sup> ADAMS Accession No. ML003740213.

<sup>75</sup> The NRC staff reviewed and accepted PG&E's revised seismic analysis in the Supplement to Safety Evaluation Report 7 (SSER 7) in 1978. This is found at ADAMS Accession No. ML14279A129.

This aspect of the design and licensing basis is unique to DCP, in that the station has three design-basis earthquakes (as opposed to only two) associated with its design, licensing and construction—DE/OBE, DDE/SSE, and HE—as described in the operating license for Unit 1 when it was issued in 1984. As stated in NUREG-0675, “Safety Evaluation Report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2,” Supplement No. 34 (SSER 34), Section 1.4, “Summary of Staff Conclusions,” dated June 1991,<sup>76</sup> “the [NRC] staff notes that the seismic qualification basis for Diablo Canyon will continue to be the original design basis [DE/OBE and DDE/SSE] plus the Hosgri evaluation basis, along with the associated analytical methods, initial conditions, etc.”

By letter dated July 14, 1978,<sup>77</sup> the Advisory Committee on Reactor Safeguards (ACRS) completed its review of the application of PG&E for authorization to operate DCP and recommended “that the seismic design of Diablo Canyon be reevaluated in about 10 years taking into account applicable new information.” As a result of the ACRS’s recommendation, the significant advances in geology, seismology, and geophysics that occurred after the beginning of the site review, and the substantial amount of offshore exploration of hydrocarbons, the NRC imposed License Condition 2.C.(7) of Facility Operating License DPR-80, which required PG&E to “update the geological, seismological, and ground-motion information, reevaluate the magnitude of the earthquake used to determine the Diablo Canyon seismic design basis, reevaluate ground motion expected at the site, reassess engineering and equipment response, and perform a seismic probabilistic risk assessment (PRA) and deterministic studies, as necessary,” as discussed in SSER 34, Section 1.1, “Background.” By

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<sup>76</sup> ADAMS Accession No. ML14279A130.

<sup>77</sup> ADAMS Legacy Library Accession No. 8601130427. To access documents in the ADAMS Legacy Library, please submit a request for the documents through the Public Document Room Web site at <https://www.nrc.gov/reading-rm/pdr.html>.

letter dated January 30, 1985, PG&E responded to the license condition by submitting a program plan for the extensive seismic design-basis reevaluation, called the LTSP, and NRC approved the plan by letter dated July 31, 1985.<sup>78</sup> By letters dated April 17, 1991, and May 29, 1991, PG&E committed to continue to study seismic issues and perform periodic seismic reviews of DCP. <sup>79</sup> Specifically, in the letter dated April 17, 1991, PG&E outlined the framework for using LTSP in the future operation of DCP, including maintaining a comprehensive data base of seismic information and providing a focus for addressing future seismic issues related to DCP. This commitment to ongoing research and review led to the development of the PG&E-USGS Cooperative Research and Development Agreement Program, which identified the Shoreline fault. SSER 34 concluded that PG&E essentially satisfied all of the four elements of the license condition that led to the LTSP, subject to resolution of one confirmatory item, which was resolved in a letter dated April 17, 1991.

As discussed previously, the Case File for DPO-2013-002 associated with Dr. Peck's DPO includes an appeal to the EDO as well as the EDO's decision on Dr. Peck's appeal, which provide additional background on the NRC's review and approval of the unique seismic design and licensing bases for DCP. In particular, the EDO decision notes: "The operating license for Unit 1, issued in 1984, was based on review of the Final Safety Analysis Report Update which included two different seismic methodologies, the DDE and the Hosgri evaluation, as documented in NUREG-0675, 'Safety Evaluation Report Related to the Operation of Diablo Canyon Power Plant, Units 1 and 2,' Supplement No. 7, dated May 1978. Given expected advances in the science of seismic evaluation, the license was also conditioned to require a confirmatory seismic study over the first 10 years of operation, referred to as the Long Term Seismic Plan (LTSP). The NRC's review and acceptance of PG&E's report on the LTSP are

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<sup>78</sup> ADAMS Legacy Library Accession Nos. 8502130385 and 8508200683, respectively.

<sup>79</sup> ADAMS Legacy Library Accession Nos. 9104300250 and 9106070210, respectively.

discussed in NUREG-0675, 'Safety Evaluation Report Related to the Operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2,' Supplement No. 34, dated June 1991 (SSER 34), and in NRC letter dated April [17], 1992, 'Transmittal of Safety Evaluation Closing Out Diablo Canyon Long-Term Seismic Program (TAC Nos. M80670 and M80671) [(ADAMS Accession No. ML14279A132)].'<sup>80</sup>

In summary, the seismic design basis for DCPD included only the DE/OBE and DDE/SSE when the AEC issued the construction permit to PG&E in 1968. However, prior to issuing the operating license in 1984, the AEC/NRC required the licensee to thoroughly evaluate, test, and complete modifications to the DCPD units to demonstrate they could also withstand ground acceleration associated with the Hosgri fault. Subsequently, the NRC staff's evaluations of PG&E's revised seismic analysis documented in SSER 7 and SSER 34 established three design-basis earthquakes (as opposed to only two) associated with DCPD's design, licensing and construction – the DE/OBE, DDE/SSE, and HE. Further, in accordance with its initial license condition (i.e., LTSP), and consistent with its regulatory commitment to the NRC, PG&E has continued to maintain a comprehensive database of seismic information and to conduct ongoing research to address current and future seismic issues related to DCPD. As set forth above, the NRC staff has considered and resolved the issues raised by the petitioner under this concern. Therefore, the NRC staff does not have a basis for expanding its current level of regulatory oversight in accordance with the NRS's Reactor Oversight Process and the Enforcement Policy, or otherwise taking the petitioner's requested enforcement actions against the licensee.

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<sup>80</sup> PDF pages 159-160 of the DPO Case File.



### III. Conclusion

The NRC does not have a basis for taking the petitioner's requested enforcement actions against the licensee. The NRC evaluated FOE's concerns, which the Commission referred to the EDO in CLI-15-14. The Commission determined in CLI-15-14 that there was no basis for immediate suspension of plant operations. During the NRC staff's review of the issues referred to the EDO, it did not find that the continued operation of DCPD would adversely affect public health and safety. Therefore, the NRC denies the petitioner's requested enforcement actions against the licensee.

As provided in 10 CFR 2.206(c), the NRC staff will file a copy of this director's decision with the Secretary of the Commission for the Commission to review. As provided for by this regulation, the decision will constitute the final action of the Commission 25 days after the date of the decision unless the Commission, on its own motion, institutes a review of the decision within that time.

Dated at Rockville, Maryland, this 21<sup>st</sup> day of April, 2017.

For the Nuclear Regulatory Commission.

A handwritten signature in black ink, appearing to read 'W. M. Dean', with a long horizontal flourish extending to the right.

William M. Dean, Director,  
Office of Nuclear Reactor Regulation.