IPRP Report No. 1

Comments on PG&E's Enhanced Seismic Study Plans for Diablo Canyon Power Plant

Background

In 2006, the California legislature enacted Assembly Bill (AB) 1632, which was codified as Public Resources Code Section 25303. AB 1632 directed the California Energy Commission (CEC) to assess the potential vulnerability of California's largest baseload power plants, which includes Diablo Canyon Power Plant (DCPP), to a major disruption due to a major seismic event and other issues. In response to AB 1632, in November 2008 the CEC issued its findings and recommendations in its AB 1632 Report, which was part of its 2008 Integrated Energy Policy Report Update.

In PG&E's 2007 General Rate Case decision D.07-03-044, the Commission directed PG&E to address and incorporate the recommendations from the AB 1632 Report into its feasibility study to extend the operating licenses of its Diablo Canyon Units 1 and 2 for an additional 20 years.

In November 2009, PG&E submitted its formal application with the Nuclear Regulatory Commission to extend the licenses of DCPP Units 1 and 2. On January 29, 2010, PG&E filed Application A.10-01-022 with the CPUC for cost recovery of $85 million associated with its DCPP license extension efforts On January 15, 2010, PG&E filed A.10-01-014 with the CPUC for cost recovery of $16.73 million associated with the enhanced seismic studies recommended by the CEC's AB 1632 Report. In accordance with the CEC AB 1632 Report to improve the public health and safety in the vicinity of California's nuclear power plants, PG&E plans to conduct 2-D and 3-D seismic studies and analyses at its Diablo Canyon Power Plant (DCPP). PG&E plans to perform these studies for on-shore and off-shore areas by using enhanced 2-D and 3-D seismic reflection mapping and other advanced geophysical techniques to explore fault zones in the vicinity of DCPP, as recommended by the CEC AB 1632 Report.

IPRP Panel

CPUC Decision D.10-08-003, issued on August 16, 2010, established that the CPUC would convene its own Independent Peer Review Panel (IPRP) and invite the CEC, the California Geologic Survey (CGS), the California Coastal Commission (CCC), and the California Seismic Safety Commission (CSSC) to participate on the panel. Under the auspices of the CPUC, the IPRP is conducting an independent review of PG&E's seismic

studies including independently reviewing and commenting on PG&E's study plan and the findings of the study, which are expected to be completed in 2013.

The IPRP convened its first meeting on August 31, 2010 at the CPUC in San Francisco. CPUC staff from Energy Division attended, as well as staff from the CEC, the California Coastal Commission, the California Geologic Survey, the California Seismic Safety Commission. At this meeting, PG&E gave a brief presentation on its proposed seismic survey study plans.

PG&E's Seismic Plans for DCPP

In its application A.10-01-014 filed with the CPUC on January 15, 2010, PG&E proposes to undertake detailed on-shore 2-D and off-shore 3-D seismic surveys of the area surrounding DCPP. To perform effective seismic surveys, PG&E indicated it will need to carefully identify the survey areas and plan on appropriate survey modeling, since there are some known areas that are tightly folded with steeply dipping basement rocks that would not be well imaged by either 2-D or 3-D seismic survey techniques. Additionally, the area surrounding the Shoreline fault zone, recently identified by the US Geological Survey is located in shallow water and not accessible by large vessels used for marine surveys. Characterization of the Shoreline fault zone and areas not well suited to imagery because of geologic considerations will require other geophysical work, e.g., multi-beam echo sounding, magnetic, or gravity surveys, as part of the seismic analysis.

The seismic line locations for the on-shore 2-D survey will also need to take into account road access, land ownership, and environmental issues. Both the 2-D and 3-D seismic surveys will be based on existing geologic models developed for PG&E's Long Term Seismic Plan along with available on-shore and off-shore industry data. These data will be used to determine how to image the features of interest and design the seismic data collection, e.g., geometry of seismic sources and receivers, number and spacing of survey lines, etc. Areas that have complex geology and dipping strata and faults may require multiple or larger survey areas than those with flat layers and simple geometries.

PG&E will be conducting off-shore 3-D seismic surveys for DCPP.

In accordance with the CEC AB 1632 Report as filed in A.10-01-014, PG&E proposes to conduct an off-shore 3-D seismic survey. Seismic imaging is a tool used by geologists and geophysics to image subsurface geologic formations. Sophisticated 3-D seismic surveys are based on a grid of closely spaced survey lines that create a high-definition three-dimensional image of the subsurface geology. Interpretation of these data provides useful information that can help discern the presence of any new geologic features and constrain uncertainties associated with known fault zones.

For on-shore areas in the vicinity of DCPP, PG&E will be conducting 2-D seismic surveys.

As with the 3-D seismic imaging techniques, the 2-D seismic survey is performed by bouncing sound waves off underground rock layers to reveal geologic structures. Unlike the dense spacing of the 3-D surveys, 2-D surveys are recorded along a single line to create a 2-D image. By combining several 2-D images on parallel lines, a quasi 3-D image can be created. For on-shore areas, 2-D surveys are preferred over 3-D surveys in the area around DCPP because of the difficulty and cost of using instruments in rugged hilly terrain, as well as land ownership and environmental issues.

PG&E will also install ocean bottom seismometers that will more accurately locate off-shore earthquakes.

In addition to the seismic surveys, PG&E will be installing ocean bottom seismometers that will more accurately locate off-shore earthquakes in conjunction with the existing on-shore seismometers. By combining earthquake locations with surface and subsurface geologic features obtained through other geologic and geophysical data collection techniques such as the 3-D and 2-D seismic surveys, PG&E will be able to more accurately image seismic fault zones. This knowledge is useful to DCPP as calculated earthquake ground motions at or near the plant site are used for assessing the safety of plant structures, systems, and components.

Comments by the California Energy Commission:

1. **Schedule, Study Plans, and Progress Reports:**

As described in the CPUC's approved decision and during more recent briefings provided by PG&E, PG&E proposes various seismic studies to address the California Energy Commission's AB 1632 Report recommended seismic studies including: shallow water/low energy off-shore 3-D imaging studies; deep water/high energy off-shore 3-D imaging studies; on-shore 2-D imaging studies of the Irish Hills area; and the installation of ocean bottom seismometers.

The California Energy Commission is pleased that PG&E is moving forward to begin the CEC's AB 1632 Report recommended seismic studies. In order to better understand PG&E's efforts and to provide meaningful feedback while participating on the Independent Peer Review Panel (IPRP), the CEC requests for members of the IPRP to receive the following additional information:

- An actual document from PG&E outlining its planned schedule and time frame for each activity and phase, e.g. Microsoft Project, Project Primavera Planner, or a Gantt chart. The CPUC decision D.10-08-003 indicates PG&E will perform the

studies sometime between now and 2013. It is critical that the IPRP have a better understanding of when the various studies will begin, their expected duration, their anticipated completion date, and when results will be available to share with the IPRP.

- The statement of work presented in the solicitation for the work or some other detailed description of the shallow water/low energy 3-D work slated to begin in October 2010. The IPRP was not able to review or comment on this study plan prior to PG&E's awarding the contract.

- More detailed descriptions of study plans *as* they are being developed. Specifically, discussion of potential study locations, technologies, or methods. This information will help the IPRP provide meaningful input to PG&E during the planning process in order for ratepayer funding to be best utilized.

- A brief description of major milestones, including permit acquisition, and the expected completion date for milestones identified by PG&E and associated with each study. For example, a significant milestone would be the completion of data collection by PG&E's contractor performing the shallow water/low energy off-shore 3-D imaging sometime in November 2010.

- Progress Reports detailing status of seismic research conducted during the reporting period including; access issues, weather problems, equipment malfunctions, etc, schedule updates, and if any unique or new features were identified and what action was taken. PG&E should submit progress reports to the IPRP periodically, either quarterly or semi-annually.

2. Notifications or modification to studies in progress:

The CEC supports the immediate start of the shallow/low energy offshore 3-D imaging work. PG&E has indicated results from the research should be ready spring of 2011. During the period of October through November 2010, while the shallow/low energy 3-D imaging data is being collected, the CEC requests the following:

- PG&E notify the IPRP when a disruption to the study occurs or when a significant finding is discovered. Should unique features be identified, the CEC prefers that PG&E further explore those features versus collecting data from areas in the greater geographical region that do not yield useful information.

- PG&E should provide criteria to be used to modify the study; e.g., 1- seismic profiles show fault dies out therefore move to different location; 2- seismic study shows stronger indication of faulting therefore extend study to fully capture the

conditions; 3- penetration depth is insufficient to make determinations therefore halt program.

3. Permitting:

PG&E has indicated that permits may be required for certain studies or portions of studies. It would be useful for PG&E to provide a list of required permits relative to each planned study and the time required, cost, and issues that are associated with each permit.

PG&E's shallow water/low energy 3-D imaging study is already permitted via the contractor, and this effort will begin shortly. However, in order to perform the deep water/high energy 3-D imaging studies the CEC believes that PG&E must obtain several special permits. These particular permits have not been granted in 20 years and have tremendous environmental restrictions. PG&E informed the IPRP and the CEC that it has met with the State Lands Commission to begin identifying what permits will be required for these studies. It is clear from these early discussions the permitting process for the deep water/high energy 3-D studies will be arduous, taking up to 18 months and requiring an Environmental Impact Report (EIR). The CEC notes that PG&E will also have to receive permits from the California Coastal Commission, Fish and Game, and perhaps other agencies not yet identified. The CEC believes that PG&E should provide the IPRP with a scoping plan for the deep water/high energy 3-D work that identifies the following:

- What permits are required?
- From which agencies?
- What barriers may prevent their being granted?
- What are the costs and time associated with each permit?

According to the CEC, the IPRP should review the permitting scoping plans and provide feedback and direction if necessary. California Energy Commissioner James Boyd and California State Senator Sam Blakeslee have both indicated they are supportive of PG&E's efforts to perform the deep water/high energy 3-D imaging. It is unclear at this time whether or not the various permitting agencies provide deference to companies performing hazard analysis versus resource studies.

4. The IPRP and external parties:

The CEC states that the level of reimbursement and or the amount of time expected to participate in these activities should be considered in CPUC/IPRP planning efforts. As directed by D.10-08-003, the CPUC has established and convened the IPRP. The CPUC expects to hire an expert technical consultant to provide technical support on geophysical, geological, and seismological issues involved in the Study. On behalf of the CPUC, the technical consultant will work with the IPRP on reviewing PG&E's study plans and results of the findings. The cost incurred for hiring the consultant will be reimbursed by PG&E in

accordance with D.10-08-003. The CPUC does not envision any other costs that will need to be reimbursed.

During the August 31st meeting at the CPUC, PG&E mentioned that the US Geologic Survey (USGS) had reviewed some of PG&E's past studies. PG&E indicates they also have an internal peer review of the AB 1632 study plans and review of completed studies. The CEC requests clarification on whether this includes or incorporates any review by the USGS.

- If the USGS is not part of PG&E's own review effort, the CEC believes that the IPRP should consider including or at least sharing the completed AB 1632 studies with staff from USGS.
- The CEC believes that the IPRP should also consider sharing its findings with the US Nuclear Regulatory Commission (NRC). In A.10-01-014, PG&E stated that the results and findings from its enhanced 2-D and 3-D seismic analyses will be incorporated into its Long Term Seismic Program, which is submitted to the NRC.

5. PG&E's proposed studies as described in Decision 10-08-003

PG&E refers to the existence of the Long Term Seismic Program (LTSP), as required by the Nuclear Regulatory Commission (NRC), to continuously study and update Diablo Canyon's seismic hazards. AB 1632 required the CEC to assess the vulnerability of the state's operating nuclear power plants to a major disruption due to a major seismic event or plant aging. The AB 1632 report acknowledges the efforts of the LTSP, but recommended that additional advanced seismic studies be performed to ensure the continued reliability of California's operating nuclear power plants. While PG&E is currently conducting its various LTSP and the AB 1632 studies, the CEC recommends that PG&E incorporate and consider all studies while planning the next phases of seismic research so that the research focuses on meaningful and useful data.

During the August 31st meeting, PG&E said it would share with the IPRP its LTSP study of the Shoreline fault, which will be completed by December 2010.

- The CEC notes that the IPRP should review the December 2010 Shoreline fault LTSP report. If the report identifies areas or features that should be studied further, and those areas are within PG&E's scope of study for its AB 1632 seismic studies, the CEC recommends that the IPRP should consider studying additional areas or features that may fall within the scope of the CPUC's decision.

D.10-08-003 Section 3.1 PG&E's Planned Seismic Studies

PG&E has generally described its on-shore 2-D and off-shore 3-D seismic surveys, and identified potential geophysical challenges, as well as permitting issues. However, there is no mention of a time frame or schedule in which work will begin. The CEC requires a better description of time frame and schedule for seismic activities.

D.10-08-003 Section 3.2 Off-shore 3-D Seismic Surveys

PG&E described the cost estimate for the off-shore surveys to be around $11 million. During the August 31st IPRP meeting in San Francisco, PG&E estimated that the shallow/low energy 3-D studies would cost roughly $5 - $7 million. Since the shallow 3-D data collection should start in October 2010 and PG&E's contractors have permits secured, there is little for the IPRP to comment on regarding this particular study other than as described. It is consistent with the AB 1632 recommendations. The CEC requests that should PG&E identify new or significant features during this period that PG&E immediately notify the IPRP and further explore the feature while they have the field crew mobilized.

After consideration of the costs associated with the shallow water/low energy 3-D mapping, there remains approximately $4 - $6 million to perform the deep water/high energy 3-D studies. The CEC notes that this cost appears to be a low estimate given the permitting issues already identified. While Ordering Paragraph 8 of D.10-08-003 will allow PG&E to request additional funding for seismic studies beyond the $16.73 million in the decision, the CEC has concerns that the cost and time associated with pursuing the deep water/high energy 3-D imaging permits could be a waste of ratepayer funding if those permits are denied. The process to obtain these specific permits requires additional exploration, and PG&E should provide the IPRP with more information and details as to its planning and scheduling of these activities.

D.10-08-003 Section 3.3 On-shore 2-D Seismic Surveys

PG&E has indicated plans are underway to perform various on-shore 2-D imaging studies and various surveys to look at areas in the Irish Hills including the Edna and Los Osos faults. During the August 31st IPRP meeting, PG&E did not identify major concerns with obtaining permits to perform these studies, and there appears to be many options for testing locations. The CEC supports the completion of these on-shore studies. While these studies are not required in PG&E's current LTSP update, the CEC recommends that such studies should be performed to identify any new or significant seismic issues.

- PG&E should update the IPRP once it identifies which surface roads they will be using for the seismic studies.

D.10-08-003 Section 3.4 Ocean Bottom Seismometer (OBS) Installation

The cost of purchasing, installing, and analyzing data from four OBS units is approximately $2.05 million, which includes $1.51 million specifically to custom manufacture them and $330, 000 for installation. PG&E has indicated that the results from the shallow/low energy 3-D seismic mapping will determine where these OBS units are located. There may be challenges with the OBS foundations. The CEC recommends that PG&E provide foundation alternatives to assure OBS units are founded on competent bedrock (drilled piers/driven piles could be necessary).

PG&E indicates that once the units are functioning and collecting data, that they will process data during the 3-year period. During the August 31st IPRP meeting, PG&E mentioned that a permit for the OBS's cabling system may be required. The CEC recommends that In addition to providing more detailed plans and scheduling details, PG&E should:

- Further explore and plan for the possibility that a permit may be required for the OBS units (specific to cables) so that their deployment is not delayed.
- Indicate in their schedule how often data will be collected and analyzed. If PG&E is only collecting and analyzing the OBS data through 2013, then we would like to see them installed and collecting data as quickly as possible.
- Consider continuing using the OBSs after the 2013 timeframe and perhaps could incorporate the associated costs in their LTSP funding.

Comments by the California Seismic Safety Commission:

Staff from the California Seismic Safety Commission (CSSC) participated in a panel lead by the California Energy Commission (CEC) in the CEC's preparation of its report called for under AB 1632 of 2006 (Blakeslee). During the CSSC participation in the CEC's panel, certain recommendations proposed by the CSSC were adopted by the CEC and others were not.

CSSC Staff has reviewed PG&E's proposed Plan in PG&E's application A.10-01-014 of January 15, 2010 to the CPUC. CSSC staff is aware of applied seismic hazard research activities that PG&E has conducted or sponsored in the vicinity of the DCPP since the AB 1632 report was released. In addition, the CSSC has:

- Reviewed PG&E's proposed Plan and related activities.
- Participated with the CEC and PG&E in the development of the Plan;
- PG&E's proposed Plan represents issues discussed in several meeting; and,
- The CSSC supports PG&E's plan as presented to the CPUC.

CSSC staff recommends that PG&E be afforded the flexibility when implementing its plan to focus on targets of interest that may be identified during the offshore survey. Such a change that warrants an investigation into the feature(s) of interest should be communicated to the CPUC. During the operations, a revision of the surveying or mapping and other field activities should not be hindered but should be justified to the CPUC for reimbursement and be discussed in detail in the interim and final reports for the seismic surveying plan and seismic hazard assessment update for the DCPP. CSSC staff also noted that gaining permits to perform deep seismic surveys in state and federal waters will be time consuming and may impact or prevent the gathering of data.

At the August 31st presentation to the IPRP, PG&E indicated that the best weather for low intensity shallow off-shore seismic surveys occurs August – November. If there are weather or operational considerations that cause some of the shallow seismic surveying work to be performed October – December of this year, the CSSC, CEC, and CCC recommend that PG&E should focus first on the areas identified as having a high potential for being relevant and of greatest scientific interest, such as the region in Area 1 where the Shoreline and Hosgri faults appear to trend toward each other.

Comments by the California Geological Survey:

While characterization of the Shoreline Fault is an important part of seismic hazard analysis for the Diablo Canyon study, the California Geological Survey (CGS) is concerned that the IPRP participants were not provided with overall project plans or schedules, nor provided with adequate technical details of the proposed 3-D survey. Without a complete description of the overall scope of the seismic investigation, and sufficiently detailed technical descriptions of each aspect of the investigation that would allow CGS to comment on the type, quality and potential value of the data to be gathered, the CGS does not believe that it can offer proper and valuable technical comments. While the CGS notes that some aspects of the investigation that were discussed at the briefing on August 31st appear to be informative, the CGS does not believe that the panel received sufficient background and context to determine how the data from the studies would be integrated with already existing data to form a new seismic hazard model of the area. The CGS believes it is not possible for it to conduct a reasonable analysis of the project based solely on a PowerPoint presentation.

The CGS believes that a peer review panel can assist the CPUC and PG&E in developing an updated seismic hazard model for Diablo Canyon. In order for the IPRP to be effective, the CGS notes that it should be provided with the details of the study plans as they are determined, and with the data and interpretations as soon as possible after they are developed. The CGS notes that technical review can take time, and constructive review

comments cannot be based on brief summary presentations of plans. Lacking additional specific details, no recommendations can be made on the adequacy of the initial operational phase set to begin in October 2010. Comments made by the IPRP members at this time are preliminary pending receipt of more information. The CGS also notes that the level of reimbursement and the amount of time expected to participate in these activities should be considered in CPUC/IPRP planning efforts.