January 30, 2004

Mr. Gregory M. Rueger
Senior Vice President, Generation and
Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Nuclear Power Plant
P.O. Box 3
Avila Beach, CA 93424

SUBJECT: DIABLO CANYON NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 – EXEMPTION FROM THE REQUIREMENTS OF 10 CFR PART 50, SECTION 50.68(b)(1) (TAC NOS. MC0992 AND MC0993)

Dear Mr. Rueger:

The Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.68(b)(1) for the Diablo Canyon Power Plant (DCPP), Unit Nos. 1 and 2. This action is in response to your letter of October 8, 2003, as supplemented by letter of November 25, 2003, that submitted a request for an exemption from the requirements of 10 CFR 50.68(b)(1) for loading, unloading, and handling of the components of the Holtec HI-STORM 100 dry cask storage system at DCPP.

A copy of the exemption has been forwarded to the Office of the *Federal Register* for publication.

Sincerely,

/RA/
Girija S. Shukla, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-275
and 50-323

Enclosure: Exemption

cc w/encl: See next page

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7590-01-P

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-275 AND 50-323

EXEMPTION

1.0 BACKGROUND

The Pacific Gas and Electric Company (the licensee) is the holder of Facility Operating License Nos. DPR-80 and DPR-82, which authorize operation of the Diablo Canyon Power Plant (facility or DCPP), Unit Nos. 1 and 2, respectively. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two pressurized water reactors located in San Luis Obispo County, California.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.68(b)(1) sets forth the following requirement that must be met, in lieu of a monitoring system capable of detecting criticality events.

> Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water.

The licensee is unable to satisfy the above requirement for handling of the 10 CFR Part 72 licensed contents of the Holtec HI-STORM 100 Cask System. Section 50.12(a) allows licensees to apply for an exemption from the requirements of 10 CFR Part 50 if the regulation is not necessary to achieve the underlying purpose of the rule and other conditions are met. The licensee stated in the application that compliance with 10 CFR 50.68(b)(1) is not necessary for handling the 10 CFR Part 72 licensed contents of the cask system to achieve the underlying purpose of the rule.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Therefore, in determining the acceptability of the licensee's exemption request, the staff has performed the following regulatory, technical, and legal evaluations to satisfy the requirements of 10 CFR 50.12 for granting the exemption.

3.1 Regulatory Evaluation

The DCPP Technical Specifications (TS) currently permit the licensee to store spent fuel assemblies in high-density storage racks in each spent fuel pool (SFP). In accordance with the provisions of 10 CFR 50.68(b)(4), the licensee takes credit for soluble boron for criticality control and ensures that the effective multiplication factor (k_{eff}) of the SFP does not exceed 0.95, if flooded with borated water. 10 CFR 50.68(b)(4) also requires that if credit is taken for soluble boron, the k_{eff} must remain below 1.0 (subcritical), if flooded with unborated water. However, the licensee is unable to satisfy the requirement to maintain the k_{eff} below 1.0 (subcritical) with unborated water, which is also the requirement of 10 CFR 50.68(b)(1). Therefore, the licensee's request for exemption from 10 CFR 50.68(b)(1) proposes to permit

the licensee to perform spent fuel loading, unloading, and handling operations related to dry cask storage, without being subcritical under the most adverse moderation conditions feasible by unborated water.

Title 10 of the *Code of Federal Regulations*, Part 50, Appendix A, "General Design Criteria (GDC) for Nuclear Power Plants," provides a list of the minimum design requirements for nuclear power plants. According to GDC 62, "Prevention of criticality in fuel storage and handling," the licensee must limit the potential for criticality in the fuel handling and storage system by physical systems or processes.

Section 50.68 of 10 CFR Part 50, "Criticality accident requirements," provides the NRC requirements for maintaining subcritical conditions in SFPs. Section 50.68 provides criticality control requirements which, if satisfied, ensure that an inadvertent criticality in the SFP is an extremely unlikely event. These requirements ensure that the licensee has appropriately conservative criticality margins during handling and storage of spent fuel. Section 50.68(b)(1) states, "Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water." Specifically, 10 CFR 50.68(b)(1) ensures that the licensee will maintain the pool in a subcritical condition during handling and storage operations without crediting the soluble boron in the SFP water.

The licensee has submitted a license application to construct and operate an Independent Spent Fuel Storage Installation (ISFSI) at DCPP. The ISFSI would permit the licensee to store spent fuel assemblies in large concrete dry storage casks. In order to transfer the spent fuel assemblies from the SFP to the dry storage casks, the licensee must first transfer the assemblies to a Multi-Purpose Canister (MPC) in the cask pit area of the SFP. The licensee performed criticality analyses of the MPC fully loaded with fuel having the highest permissible reactivity, and determined that a soluble boron credit was necessary to ensure that

the MPC would remain subcritical in the SFP. Since the licensee is unable to satisfy the requirement of 10 CFR 50.68(b)(1) to ensure subcritical conditions during handling and storage of spent fuel assemblies in the pool with unborated water, the licensee identified the need for an exemption from the 10 CFR 50.68(b)(1) requirement to support MPC loading, unloading, and handling operations, without being subcritical under the most adverse moderation conditions feasible by unborated water.

The staff evaluated the possibility of an inadvertent criticality of the spent nuclear fuel at DCPP during MPC loading, unloading, and handling. The staff has established a set of acceptance criteria that, if met, satisfy the underlying intent of 10 CFR 50.68(b)(1). In lieu of complying with 10 CFR 50.68(b)(1), the staff determined that an inadvertent criticality accident is unlikely to occur if the licensee meets the following five criteria:

1. The cask criticality analyses are based on the following conservative assumptions:
    a. All fuel assemblies in the cask are unirradiated and at the highest permissible enrichment,
    b. Only 75 percent of the Boron-10 in the Boral panel inserts is credited,
    c. No credit is taken for fuel-related burnable absorbers, and
    d. The cask is assumed to be flooded with moderator at the temperature and density corresponding to optimum moderation.
2. The licensee's ISFSI TSs require the soluble boron concentration to be equal to or greater than the level assumed in the criticality analysis and surveillance requirements necessitate the periodic verification of the concentration both prior to and during loading and unloading operations.
3. Radiation monitors, as required by GDC 63, "Monitoring Fuel and Waste Storage," are provided in fuel storage and handling areas to detect excessive radiation levels and to initiate appropriate safety actions.

4. The quantity of other forms of special nuclear material, such as sources, detectors, etc., to be stored in the cask will not increase the effective multiplication factor above the limit calculated in the criticality analysis.

5. Sufficient time exists for plant personnel to identify and terminate a boron dilution event prior to achieving a critical boron concentration in the MPC. To demonstrate that it can safely identify and terminate a boron dilution event, the licensee must provide the following:

   a. A plant-specific criticality analysis to identify the critical boron concentration in the cask based on the highest reactivity loading pattern.

   b. A plant-specific boron dilution analysis to identify all potential dilution pathways, their flowrates, and the time necessary to reach a critical boron concentration.

   c. A description of all alarms and indications available to promptly alert operators of a boron dilution event.

   d. A description of plant controls that will be implemented to minimize the potential for a boron dilution event.

   e. A summary of operator training and procedures that will be used to ensure that operators can quickly identify and terminate a boron dilution event.

3.2 Technical Evaluation

In determining the acceptability of the licensee's exemption request, the staff reviewed three aspects of the licensee's analyses: (1) criticality analyses submitted to support the ISFSI license application, (2) boron dilution analysis, and (3) legal basis for approving the exemption. For each of the aspects, the staff evaluated whether the licensee's analyses and methodologies provide reasonable assurance that adequate safety margins are developed and can be maintained in the DCPP SFP during loading of spent fuel into canisters for dry cask storage.

3.2.1 Criticality Analyses

For evaluation of the acceptability of the licensee's exemption request, the staff reviewed the criticality analyses provided by the licensee in support of its ISFSI license application. Chapter 6, "Criticality Evaluation," of the HI-STORM Final Safety Analysis Report (HI-STORM FSAR) contains detailed information regarding the methodology, assumptions, and controls used in the criticality analysis for the MPCs to be used at DCPP. The staff reviewed the information contained in Chapter 6 as well as information provided by the licensee in its exemption request to determine if Criterion 1 through 4 of Section 3.1 were satisfied.

First, the staff reviewed the methodology and assumptions used by the licensee in its criticality analysis to determine if Criterion 1 was satisfied. The licensee provided a detailed list of the assumptions used in the criticality analysis in Chapter 6 of the HI-STORM FSAR. The licensee stated that it took no credit in the criticality analyses for burnup or fuel-related burnable absorbers. The licensee also stated that all assemblies were analyzed at the highest permissible enrichment. Additionally, the licensee stated that all criticality analyses for a flooded MPC were performed at temperatures and densities of water corresponding to optimum moderation conditions. Finally, the licensee stated that it only credited 75 percent of the Boron-10 content for the fixed neutron absorber, Boral, in the MPC. Based on its review of the criticality analyses contained in Chapter 6 of the HI-STORM FSAR, the staff finds that the licensee has satisfied Criterion 1.

Second, the staff reviewed the proposed Diablo Canyon ISFSI TS. The licensee's criticality analyses credit soluble boron for reactivity control during MPC loading, unloading, and handling operations. Since the boron concentration is a key safety component necessary for ensuring subcritical conditions in the pool, the licensee must have conservative TS capable of ensuring that sufficient soluble boron is present to perform its safety function. The most limiting loading configuration of an MPC requires 2600 parts-per-million (ppm) of soluble boron to

ensure the k_{eff} is maintained below 0.95, the regulatory limit relied upon by the staff for demonstrating compliance with the requirements of 10 CFR 72.124(a). Proposed TS 3.2.1, "Dissolved Boron Concentration," requires the soluble boron concentration in the MPC cavity be greater than or equal to the concentrations assumed in the criticality analyses under a variety of MPC loading configurations. In all cases, the boron concentration required by the proposed ISFSI TS ensures that the k_{eff} will be below 0.95 for the analyzed loading configuration. Additionally, the licensee's proposed ISFSI TS contains surveillance requirements which ensure it will verify that the boron concentration is above the required level both prior to and during MPC loading, unloading, and handling operations. Based on its review of the proposed Diablo Canyon ISFSI TSs, the staff finds that the licensee has satisfied Criterion 2.

Third, the staff reviewed the DCPP Final Safety Analysis Report (FSAR) Update and the information provided by the licensee in its exemption request to ensure that it complies with GDC 63. GDC 63 requires that licensees have radiation monitors in fuel storage and associated handling areas to detect conditions that may result in a loss of residual heat removal capability and excessive radiation levels and initiate appropriate safety actions. As a condition of receiving and maintaining an operating license, the licensee must comply with GDC 63. The staff reviewed the DCPP FSAR Update and exemption request to determine whether it had provided sufficient information to demonstrate continued compliance with GDC 63. Based on its review of both documents, the staff finds that the licensee complies with GDC 63 and has satisfied Criterion 3.

Finally, as part of the criticality analysis review, the staff evaluated the storage of non-fuel related material in an MPC. The staff evaluated the potential to increase the reactivity of an MPC by loading it with materials other than spent nuclear fuel and fuel debris. Section 2.0, "Approved Contents," of the proposed Diablo Canyon ISFSI TS limits the cask contents to spent nuclear fuel, fuel debris, and non-fuel hardware. The Diablo Canyon ISFSI FSAR Tables

10.2-1 through 10.2-4 provide limitations on the materials that can be stored in the various MPC designs intended to be used at the Diablo Canyon ISFSI. The staff determined that the loading limitations described in Tables 10.2-1 through 10.2-4 will ensure that non-fuel hardware loaded in the MPCs will not result in a reactivity increase. Based on its review of the loading restrictions for non-fuel hardware, the staff finds that the licensee has satisfied Criterion 4.

3.2.2 Boron Dilution Analysis

Since the licensee's ISFSI application relies on soluble boron to maintain subcritical conditions within the MPCs during loading, unloading and handling operations, the staff reviewed the licensee's boron dilution analysis to determine whether appropriate controls, alarms, and procedures were available to identify and terminate a boron dilution accident prior to reaching a critical boron concentration.

At the staff's request, the licensee provided additional information describing the boron dilution analysis it performed. First, the licensee performed a criticality analysis to determine the DCPP critical boron concentration, 1720 ppm, during MPC loading, unloading, and handling operations. Therefore, the DCPP SPF boron concentration would have to decrease from the ISFSI TS limit of 2600 ppm to the critical boron concentration 1720 ppm before SPF criticality is possible. This analysis assumed that a fully loaded MPC-32 canister containing fresh fuel of the maximum permissible enrichment is uniformly diluted to the critical boron concentration. The licensee based the remainder of its boron dilution analysis and its preventive and mitigative actions on preventing the MPC from reaching this concentration.

The licensee referenced a detailed analysis of the boron dilution event previously performed for DCPP and submitted to the NRC. In this analysis, the licensee determined all of the potential dilution pathways for adding makeup water to the DCPP SFP. The pathway with the maximum flowrate is from the demineralized water system to the SFP via valve 803, which can provide a maximum flowrate of 494 gallons per minute (gpm). Based on this maximum

flowrate, the licensee calculated a time line for the boron dilution event, and determined that, starting from the SFP low level alarm setpoint, it would take 39 minutes to reach the SFP high level alarm. It would take an additional 10 minutes before the SFP began to overflow. Finally, approximately five hours after the SFP high level alarm setpoint was reached, the critical boron concentration would be achieved.

To demonstrate that it has ample time and opportunity to identify and terminate a boron dilution event, the licensee described the alarms, procedures, and administrative controls it has in place. The licensee described the alarms available to operators to identify a boron dilution event. The SFP high level and low level alarms are annunciated in the control room and the operator response is described in a response procedure. Additionally, operators are trained to terminate any boron dilution source within one-half hour of receiving the high level alarm. In addition to the high level alarm, the operators would receive indication of a boron dilution event from the liquid waste systems alarms caused by the overflowing pool water ending up in the fuel handling building floor drains. As part of its pool monitoring program, operations personnel perform rounds in the SFP area once every shift where they check the level of the pool and the conditions around the pool. Also, while cask loading operations are in progress, numerous plant personnel would be working next to the SFP where they could easily identify any level changes. The licensee stated that during any delays where the SFP is not continuously monitored, exceeding those for normal shift changes and breaks, either trained personnel will be assigned to monitor the SFP or the frequency of operator rounds will be increased.

The licensee stated that it will implement additional temporary administrative controls while the MPC is in the SFP to minimize the possibility of a boron dilution event. The licensee stated that except for the primary water station near the SFP, which is used for the decontamination process and rinsing dry cask storage equipment as it is removed from the SFP, at least one valve in each potential flow path of unborated water to the SFP will be closed

and tagged out. As an additional precaution, the licensee will double isolate the flow path with the highest potential flowrate of 494 gpm. The licensee will close and tag out two valves in this flow path to minimize the potential that it can cause a boron dilution event.

Finally, to ensure that operators are capable of identifying and terminating a boron dilution event during MPC loading, unloading, and handling operations, the licensee will incorporate the changes made to the operating procedures relating to the SFP boron dilution flow paths into the DCPP operator training program. The licensee stated that the training will emphasize the importance of avoiding any inadvertent additions of unborated water to the SFP, responses to be taken to alarms that may be indicative of a potential boron dilution event during cask loading and fuel movement in the SFP, and identification of the potential for a boron dilution event during decontamination rinsing activities.

Based on the staff's review of the licensee's exemption request, the additional information it provided, and its boron dilution analysis, the staff finds the licensee has provided sufficient information to demonstrate that it satisfies Criterion 5.

3.3 Legal Basis for the Exemption

Pursuant to 10 CFR 50.12, "Specific Exemption," the staff reviewed the licensee's exemption request to determine if the legal basis for granting an exemption had been satisfied, and concluded that the licensee has satisfied the requirements of 10 CFR 50.12. With regards to the six special circumstances listed in 10 CFR 50.12(a)(2), the staff finds that the licensee's exemption request satisfies 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." Specifically, the staff concludes that since the licensee has satisfied the five criteria in Section 3.1 of this exemption, the application of the rule is not necessary to achieve its underlying purpose in this case.

3.4 Staff Conclusion

Based upon the review of the licensee's exemption request to credit soluble boron during MPC loading, unloading, and handling in the DCPP SFP, the staff concludes that pursuant to 10 CFR 50.12(a)(2) the licensee's exemption request is acceptable. However, the staff limits its approval to the loading, unloading, and handling of the components of the HI-STORM 100 dual-purpose dry cask storage system at DCPP.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Pacific Gas and Electric Company an exemption from the requirements of 10 CFR 50.68(b)(1) for the loading, unloading, and handling of the components of the HI-STORM 100 dual-purpose dry cask storage system at DCPP. Any changes to the cask system design features affecting criticality or its supporting criticality analyses will invalidate this exemption.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (69 FR 2012).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 30th day of January 2004.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Ledyard B. Marsh, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation