

October 6, 2004

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

SUBJECT: DIABLO CANYON POWER PLANT, UNIT NOS. 1 AND 2 - ISSUANCE OF
AMENDMENT RE: REVISED WEDGE REGION EXCLUSION ZONES FOR
STEAM GENERATOR TUBE ALTERNATE REPAIR CRITERIA (ARC)
(TAC NOS. MC1647 AND MC1648)

Dear Mr. Rueger:

The Commission has issued the enclosed Amendment No. 176 to Facility Operating License No. DPR-80 and Amendment No. 178 to Facility Operating License No. DPR-82 for the Diablo Canyon Power Plant, Unit Nos. 1 and 2, respectively. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated December 19, 2003, and its supplement dated May 13, 2004.

The amendments change Technical Specification 5.5.9, "Steam Generator (SG) Tube Surveillance Program" to revise the wedge region exclusion zones for outside diameter stress corrosion cracking alternate repair criteria (ARC) at tube support plate (TSP) intersections and for primary water stress corrosion cracking ARC at dented TSP intersections. The new wedge region exclusion zones are based on new analyses of loss-of-coolant accident plus safe shutdown earthquake loads completed in 2003 using plant-specific accident loads.

A copy of the related Safety Evaluation is enclosed. The Notice of Issuance will be included in the Commission's next regular biweekly *Federal Register* notice.

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

Enclosures: 1. Amendment No. 176 to DPR-80
2. Amendment No. 178 to DPR-82
3. Safety Evaluation

cc w/encls: See next page

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Office of Nuclear Reactor Regulation

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DISTRIBUTION:

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Enclosures: 1. Amendment No.176 to DPR-80 PDIV-2 Reading GHill (4)
2. Amendment No. 178 to DPR-82 RidsNrrDlpmPdiv (HBerkow) KManoly
3. Safety Evaluation RidsNrrDlpmPdiv2 (RGramm) FOrr

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NRR-058

w/comments

OFFICE	PDIV-2/PM	PDIV-2/LA	EMEB/SC*	SRXB/SC*	OGC	PDIV-2/SC
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DATE	7/24/04	9/22/04	8/13/04	9/13/04	10/4/04	10/5/04

Diablo Canyon Power Plant, Units 1 and 2

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PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-275

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 176
License No. DPR-80

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Pacific Gas and Electric Company (the licensee) dated December 19, 2003, and its supplement dated May 13, 2004, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-80 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 176, are hereby incorporated in the license. Pacific Gas and Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan, except where otherwise stated in specific license conditions.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: October 6, 2004

PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-323

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 178
License No. DPR-82

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Pacific Gas and Electric Company (the licensee) dated December 19, 2003, and its supplement dated May 13, 2004, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-82 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 178, are hereby incorporated in the license. Pacific Gas and Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan, except where otherwise stated in specific license conditions.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: October 6, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 176

TO FACILITY OPERATING LICENSE NO. DPR-80

AND AMENDMENT NO. 178 TO FACILITY OPERATING LICENSE NO. DPR-82

DOCKET NOS. 50-275 AND 50-323

Replace the following page of the Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

REMOVE

5.0-14

INSERT

5.0-14

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 176 TO FACILITY OPERATING LICENSE NO. DPR-80
AND AMENDMENT NO. 178 TO FACILITY OPERATING LICENSE NO. DPR-82
PACIFIC GAS AND ELECTRIC COMPANY
DIABLO CANYON POWER PLANT, UNITS 1 AND 2
DOCKET NOS. 50-275 AND 50-323

1.0 INTRODUCTION

By application dated December 19, 2003, and its supplement dated May 13, 2004, Pacific Gas and Electric Company (PG&E or licensee) requested changes to the Technical Specifications (TSs) (Appendix A to Facility Operating License Nos. DPR-80 and DPR-82) for the Diablo Canyon Power Plant (DCPP), Units 1 and 2.

The amendments would revise the wedge region exclusion zones based on new analyses of loss-of-coolant accident (LOCA) plus safe shutdown earthquake (SSE) loads completed in 2003 using plant-specific accident loads. The licensee proposed new steam generator (SG) wedge region exclusion zones for outside diameter stress corrosion cracking (ODSCC) alternate repair criteria (ARC) at tube support plate (TSP) intersections and for primary water stress corrosion cracking (PWSCC) ARC at dented TSP intersections.

Wedge region exclusion zones are tube locations ineligible for the application of ARC because LOCA plus SSE loads could result in permanent tube deformation. Wedge regions are made up of tubes located adjacent to wedges that provide support for the TSPs. Pre-existing through-wall cracks in tubes that are left in service under ARC and that may deform under a postulated LOCA plus SSE loads event may result in secondary-to-primary in-leakage following the event. Therefore, tubes that have crack-like indications in the wedge region exclusion zone are excluded from ARC.

The new wedge region exclusion zones are based on new analyses of LOCA plus SSE loads completed in 2003 using plant-specific accident loads. The new wedge region exclusion zone results in a reduction in the number of tubes excluded from the ARC, when compared to the prior wedge region exclusion zone approved by the NRC, and is therefore less restrictive.

The May 13, 2004, supplemental letter provided additional clarifying information, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on February 3, 2004 (69 FR 5205).

2.0 REGULATORY EVALUATION

The licensee stated that NRC Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," provides guidance to implement the alternate tube repair criteria applicable to ODSCC at the tube-to-TSP intersections in Westinghouse-designed steam generators (SGs). The licensee stated in Attachment D of PG&E Letter DCL-97-034 that it would not apply the repair criteria to tube-to-TSP intersections where the tubes with degradation might collapse or deform as a result of the combined postulated LOCA plus SSE loads. The revised analysis was performed by Westinghouse in accordance with the guideline provided in this GL to identify which intersections and how many tubes are to be excluded from application of ARC. The NRC's acceptance criteria are based on General Design Criteria (GDC) 2, 4, 14, 15, and 19 of Appendix A to 10 CFR Part 50, and 10 CFR Part 100. Other documents used by the staff as guidance for the review are Standard Review Plan (SRP) Sections 3.9.1, 3.9.2, and 3.9.3.

3.0 TECHNICAL EVALUATION

The licensee stated that the NRC approved implementation of voltage-based ODSCC ARC at DCPD Units 1 and 2 in License Amendments Nos. 124 and 122, dated March 12, 1998, and the NRC also approved implementation of PWSCC ARC at DCPD Units 1 and 2 in Amendment Nos. 152 and 152, dated May 1, 2002. In both of these ARC, certain intersections located in wedge regions are excluded from application of ARC since they could potentially deform following a postulated LOCA plus SSE loads event. The wedge regions are made up of tubes located adjacent to the wedges, that provide support for the TSPs. The licensee also stated that the LOCA plus SSE loads could result in yielding of the TSP in the vicinity of the wedge groups, accompanied by deformation of SG tubes. Tube deformation could lead to opening of pre-existing tight through-wall cracks, resulting in secondary-to-primary in-leakage following the event.

Secondary-to-primary in-leakage is a potential concern because, although not quantified, in-leakage could have an adverse effect on the Final Safety Analysis Report (FSAR) Update safety analysis results. Therefore, any tubes that are predicted to deform under LOCA plus SSE loads are excluded from application of ARC.

The licensee further stated that the revised LOCA plus SSE loads analysis, completed by Westinghouse in 2003, incorporates DCPD-specific LOCA and seismic loads and considers varying tube support conditions that bound potential support conditions that may exist in the DCPD tube bundle (both pre- and post-chemical cleaning). In determining the number of potentially affected tubes, enveloping loads from both the seismic and LOCA analyses are used.

Loading Evaluation

In the 2003 revised analysis, both the LOCA loads and the SSE loads together with the methods of analyses are different from those used in 1992 analysis.

LOCA Hydraulic Loads

In a letter dated May 13, 2004, the licensee discussed LOCA hydraulic loads. The licensee provided a table summarizing a comparison of methods used, the bases for their use, and the limiting break sizes analyzed between a DCPD 1992 analysis of hydraulic loads and the proposed DCPD 2003 LOCA analysis of hydraulic loads. Both analyses used similar versions of the Westinghouse MULTIFLEX code.

The MULTIFLEX 1.0 version, which was used in the 1992 analysis, was approved in an NRC Safety Evaluation Report (SER) dated June 17, 1977. The analysis assumed a rupture of one steam generator outlet 31" pipe.

The MULTIFLEX 3.0, which was used in the 2003 analysis, also calculates the LOCA blowdown loads. The version MULTIFLEX 3.0 used for the 2003 analysis is considered by Westinghouse to be an improved version that was developed specifically for the Westinghouse Owners Group Baffle/Barrel Bolt Program (BBBP). In a 1999 application of MULTIFLEX 3.0 to the D.C. Cook plants, Westinghouse stated that previous BBBP analyses performed using MULTIFLEX 3.0 were accepted by the NRC.

The NRC has not performed a detailed review of the MULTIFLEX 3.0 code, but has found the methodology reasonable and acceptable (e.g., for the D.C. Cook plants, SER dated December 28, 1999). The D.C. Cook and DCPD designs are sufficiently alike that the staff considers the MULTIFLEX 3.0 also applicable to DCPD. Leak-before-break analyses determined that the limiting break assumed in the DCPD 2003 analyses would be a 14-inch line break in the residual heat removal system. This differs from the 1992 analyses.

Based on the above, the staff finds that MULTIFLEX 3.0 is acceptable for calculating LOCA thermal hydraulic loads for the DCPD 2003 analysis.

Seismic Loads

The licensee stated that plant-specific response spectra for DCPD are used to obtain the loads and stresses in the tube bundle internals. SSE is used in a generic sense to represent the seismic event categorized as a faulted event. For DCPD, the limiting faulted seismic event is the double design earthquake (DDE). The DDE stresses in the tubes are greater than the Hosgri-induced stresses, which are obtained based on a postulated earthquake event originating from the Hosgri fault, which was discovered 5km from the DCPD site in 1971. In calculating the stresses in the affected tubes, plate loads from an analysis of the DDE event are used.

In requests for additional information (RAI) dated March 2 and 23, 2004, the staff requested the licensee to explain the reason that the stresses in the tubes are greater for the DDE condition than the Hosgri condition analysis results. Specifically, the staff requested the licensee to provide the plant-specific response spectra at ground and at SG support locations under DDE and Hosgri earthquakes, and to explain why the limiting faulted seismic event is the DDE.

By letter dated May 13, 2004, the licensee responded to the above requests by providing plots of the seismic spectra used in the 1992 and 2003 analyses. The licensee stated that

comparison of the horizontal support spectra for the DDE and the Hosgri earthquakes, for the 2003 analysis, shows that the peak accelerations for the DDE seismic event (8 to 9 g's horizontal) bound the spectra for the Hosgri seismic event (6 g's horizontal). The vertical spectra for the Hosgri event is slightly higher than the DDE event (1.7 g's versus 1.3 g's). However, the horizontal response of the SGs is the dominant loading in terms of the in-plane SG TSP loads. The relative magnitudes of the tube stresses and plate loads for the DDE spectra and the Hosgri spectra are consistent with the relative magnitudes of the two SG support spectra. The staff finds the licensee's response regarding the comparison between the DDE and Hosgri seismic analysis results reasonable and acceptable. Upon examination of the support response spectra for the DDE and Hosgri conditions, the staff noted that the higher damping value used for the Hosgri seismic evaluation is one of the contributing factors to the determination that the DDE was the limiting faulted event.

In its approval of License Amendment Nos. 124 and 122, dated March 12, 1998, the NRC accepted the nonlinear transient dynamic analysis methodology used in the 1992 analysis. In the March 2 and 23, 2004, RAIs, the staff requested the licensee to describe any differences in seismic loads and methods of analysis used in the 1992 analysis and the 2003 analysis.

In its May 13, 2004 letter, the licensee discussed the differences between the 1992 analysis and the 2003 analysis. The licensee stated that the fundamental difference between the DDE TSP loads for the 1992 and 2003 analyses is that the DDE loads for the 1992 analysis are estimated from existing loads for another plant (Plant X) while the 2003 DDE loads are the result of a plant-specific seismic analysis for DCPD. For the 1992 analysis, the DDE TSP loads for DCPD were estimated based on an analysis for another plant and a comparison of the applied spectra and the DCPD spectra. For the 2003 analysis, the TSP loads, due to seismic for DCPD, were calculated using an analysis that is specific to DCPD and the application of the DCPD-specific DDE support response spectra. Both the 1992 and 2003 analyses utilized a non-linear time history analysis methodology; however, the 1992 analysis used the WECAN computer code (and the Plant X seismic time history), while the 2003 analysis used the ANSYS computer code (and the DCPD seismic time history). For the 1992 analysis, the maximum plate load due to seismic DDE was estimated to be 289.91 kips, versus 278.4 kips for the DCPD plant-specific 2003 analysis.

The licensee further stated that one significant difference between the 1992 analysis and the 2003 analysis is that loads were calculated for each TSP for the 2003 plant specific analysis, whereas only one load that was conservatively assumed to occur at each plate was calculated for the 1992 analysis. For the 1992 analysis, the maximum plate load for seismic DDE (289.91 kips) was assumed to occur at the top TSP, whereas the maximum plate load for the 2003 analysis was determined to occur at the bottom plate in the bundle. The maximum load for the top plate in the 2003 analysis is 186.3 kips. The combined LOCA plus SSE load for the top plate for the 1992 analysis was 343.64 kips, versus 191.37 kips for the 2003 analysis. For the 1992 analysis, it was assumed that the combined load of 343.64 kips occurred at each plate. The 2003 analysis maximum plate loads for Plates 2-6 are on the order of 200 kips, 42 percent less than the estimated plate load of 343.64 kips assumed for the 1992 analysis.

The staff finds the licensee's comparison of the 1992 and 2003 analyses to be reasonable and acceptable.

Combined LOCA Plus SSE Loads and Identification of Potentially Susceptible Tubes

In support of the amendment request, the licensee used approaches similar to those approved by the NRC for License Amendment Nos. 124 and 122, for the combined LOCA plus SSE loads and the identification of potentially susceptible tubes. To better understand the final results in the determination of which affected SG tubes would be included in the revised wedge region exclusion zones, the staff requested the licensee in the March 2 and 23, 2004, RAIs, to describe the factors that contributed to the significant reduction in the number of tubes that are excluded from the application of ARC for the DCPG SG tubes as a result of the 2003 analysis. The staff also requested the licensee to clarify the "uncertainties in the analysis."

In its May 13, 2004 letter, the licensee described the factors that led to the reduction in the number of tubes excluded from the application of SG ARC for the DCPG SG tubes as follows:

- The reduction in plate load due to combined LOCA plus SSE is from 343.64 kips to 278.4 kips for the limiting plate, and from 343.64 kips to approximately 200 kips for the remaining plates. The reduction in load from 343.64 kips for the limiting plate to 200 kips for Plates 2-7 represents a reduction in load of 42 percent. (Note that the reduction in the number of excluded tubes from 462 to 262, a 43 percent reduction, is consistent with the reduction in load).
- For the 1992 analysis, each of the six wedge locations for each plate was assumed to experience the same area reduction. The 2003 analysis showed that the various wedge groups around the plate periphery experience different peak loads. This variation in peak load was accounted for in determining the number of affected tubes for each of the wedge locations. The maximum loads cited in Item "a" above correspond to the highest loads experienced at any of the six wedge locations. Some wedge locations experienced loads well below the maximum load, as low as 75 kips at one location.
- The methodology for estimating the number of affected tubes for the 1992 analysis was based on the plate crush tests for the Model D SGs with a factor of three applied to account for load differences. This resulted in a conservative upper bound estimate of 7.5 percent flow area reduction for the DCPG SGs. The 7.5 percent area reduction was distributed equally to each of the six wedge locations and corresponded to 42 tubes per wedge location. To account for uncertainties in selecting the susceptible tube locations, an enveloping group of tubes was selected at each of the six wedge locations, resulting in a total of 468 tubes per S/G conservatively included in the wedge region exclusion zones.

For the 2003 analysis, the number of tubes predicted to be deformed was based on plate crush tests for the Model 51 SG plates. These tests accounted for the orientation of the wedges and hole penetration patterns relative to the direction of load.

In regard to the "uncertainties in the analysis," the licensee stated in its May 13, 2004, response that the "uncertainties in the analysis" refer to the uncertainty in defining a specific set of tube locations from the crush tests. There is no need to increase the number of excluded tubes to account for uncertainties in the seismic and LOCA analyses. The licensee indicated that the seismic and LOCA analyses have been performed in a conservative manner such that the calculated plate loads provide additional conservatism in the analysis. For instance, the LOCA analysis assumes that the maximum load contribution from each tube occurs at the same time in the transient. In actuality, the maximum loads occur at different times; and at any given time during the transient the load in different tube bundle radii may oppose each other. For the seismic analysis, the lumping of tube masses is such that the maximum plate loads are higher than would be expected if each tube were modeled separately. The grouping of tubes assumes that all of the straight leg tubes respond in unison during the seismic event, which the licensee considers as a conservative assumption.

The licensee further stated that, as noted in the amendment request, the "uncertainties in the analysis" address "issues like misalignment of holes and other local anomalies (that) could cause a slightly different set of tubes to be deformed than indicated in the plate crush tests." The specific tubes included in the exclusion zones are based initially on the test results, with additional tubes, predominantly on the periphery of the affected area, being included to address the above uncertainties. Overall, the number of tubes selected for the exclusion zones result in a factor of safety of over two being applied to the calculated number of affected tubes. (The licensee noted that finite element analyses performed to evaluate the effects of local anomalies, such as a missing ligament in the vicinity of wedge groups, have shown such local anomalies to have little or no effect on the plate stresses in the vicinity of the wedges. Therefore, the licensee considered a factor of over two on the number of excluded tubes conservative relative to the effect of local anomalies). The methodology for defining the applicable tubes to be excluded is identical to the methodology discussed and approved in the NRC letter to PG&E dated March 12, 1998, for License Amendment Nos. 124 and 122.

The staff finds the licensee's load combination methodology and the methodology for the identification of potential susceptible SG tubes to be excluded from the ARC to be reasonable and acceptable.

Conclusion

Based on its review as discussed above, the staff finds the licensee's determination of revised wedge region exclusion zones, for SG tube ARC based on new analyses of LOCA plus SSE loads using plant-specific accident loads, to be reasonable and acceptable. Based on the evaluation above, the staff finds that the proposed TS changes are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the California State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration and there has been no public comment on such finding (69 FR 5205). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: P.Y. Chen
F. Orr

Date: October 6, 2004