



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

June 23, 1998

50-275/323

Mr. Gregory M. Rueger, Senior Vice President  
and General Manager  
Pacific Gas and Electric Company  
NPG - Mail Code A10D  
P. O. Box 770000  
San Francisco, California 94177

SUBJECT: SECOND REQUEST FOR ADDITIONAL INFORMATION - REVIEW OF  
WCAP-14707, "MODEL 51 STEAM GENERATOR LIMITED TUBE SUPPORT  
PLATE DISPLACEMENT ANALYSIS FOR DENTED OR PACKED TUBE TO  
TUBE SUPPORT PLATE CREVICES," DIABLO CANYON, UNITS 1 AND 2  
(TAC NOS. M99011 AND M99012)

Dear Mr. Rueger:

In a letter dated October 4, 1996, Pacific Gas and Electric Company (PG&E), submitted for staff review and approval a technical report prepared by Westinghouse Electric Corporation that assesses the potential for tube support plate (TSP) displacement during a postulated main steam line break (MSLB) event. The report, WCAP-14707, "Model 51 Steam Generator Limited Tube Support Plate Displacement Analysis for Dented or Packed Tube to Tube Support Plate Crevices," concludes that the TSPs in Model 51 steam generators (SGs) are essentially "locked" in place due to corrosion product buildup in the tube-to-TSP crevices. If the TSPs do not move under accident conditions, the probability of tube burst resulting from degradation located within the TSP intersections drops significantly because of the TSP constraint. The report also concludes that the presence of corrosion product buildup in the crevice significantly obstructs accident-induced leakage through degradation located within the TSP intersections. In the submittal, you stated that PG&E plans to apply the conclusions of WCAP-14707 as part of an alternate repair criteria (ARC) for primary water stress corrosion cracking (PWSCC) located at the TSP intersections. The staff expects PG&E to submit a license amendment request for the ARC within the next 6 months.

In a meeting held November 20, 1996, PG&E, Westinghouse and NRC staff representatives discussed the influence of corrosion product buildup in the tube-to-TSP crevices on the structural and leakage integrity of degraded SG tubes. The staff noted at the time, as described in a meeting summary dated March 25, 1997, that such an approach involved policy implications that would need to be addressed prior to commencing any technical review.

In a meeting held April 10, 1997, between PGE and NRC staff representatives, the staff informed PG&E that it would take under consideration the argument that corrosion product buildup results in "locking" of the TSPs and greatly reduces accident leak rates. The staff indicated that its technical review would be very detailed and, in addition to the difficult materials engineering issues, would include risk issues associated with severe accident considerations. The staff indicated that the licensee should expect the review process to be

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lengthy because of the unique nature of the proposal and its proposed broad application. The staff also cautioned PG&E that there were a number of uncertainties related to both technical issues and policy issues that will have to be addressed during this review and that the outcome of this review is not certain.

Since the April 10, 1997 meeting, the Materials and Chemical Engineering Branch (EMCB) staff of the Office of Nuclear Reactor Regulation (NRR) completed an initial review of Section 4.0, "Axial Pull Force Tests for TSP Displacement and Leakage Tests with Dented or Packed TSP Intersections" of WCAP-14707 and a Request for Additional Information (RAI) was issued on December 2, 1997. PGE responded in a letter dated February 23, 1998. The staff recently completed its review of Section 4.0 of WCAP-14707 and completed a review of the PG&E submittal of February 23, 1998. As stated earlier, given the unconventional generic implications of the WCAP conclusions and given the difficult issue of justifying reliance on corrosion products to ensure SG tube integrity, the staff required the contents of WCAP-14707 to provide a substantial technical basis for its conclusions. We do not believe the WCAP, as it is currently written, meets the staff's requirements for approval. Accordingly, a second request for additional information is listed in the enclosure. This RAI applies only to Section 4.0 of WCAP-14707. Other NRR branches have responsibility for the review of the remaining portions of the report.

The staff expects that a complete response to the RAI will require additional testing that will cost PG&E significantly in terms of both time and money without a guarantee of a successful outcome. Given the time frame in which you wish to implement an ARC for PWSCC located at the TSPs, the staff recommends that PG&E reconsider the current approach to tube-locking in view of our mutually limited resources and consider pursuing an ARC for PWSCC without reliance on corrosion product buildup to ensure tube structural and leakage integrity. There are alternative approaches that accomplish at least partly the goals of WCAP-14707 that are much more likely to meet with success.

Please contact me at (301) 415-1313 if you need additional information about this RAI and when you are prepared to discuss a schedule for providing your response.

Sincerely,  
Original Signed By  
Steven D. Bloom, Project Manger  
Project Directorate IV-2  
Division of Reactor Projects III/IV  
Office of Nuclear Reactor Regulation

Docket Nos. 50-275  
and 50-323

Enclosure: Request for Additional  
Information

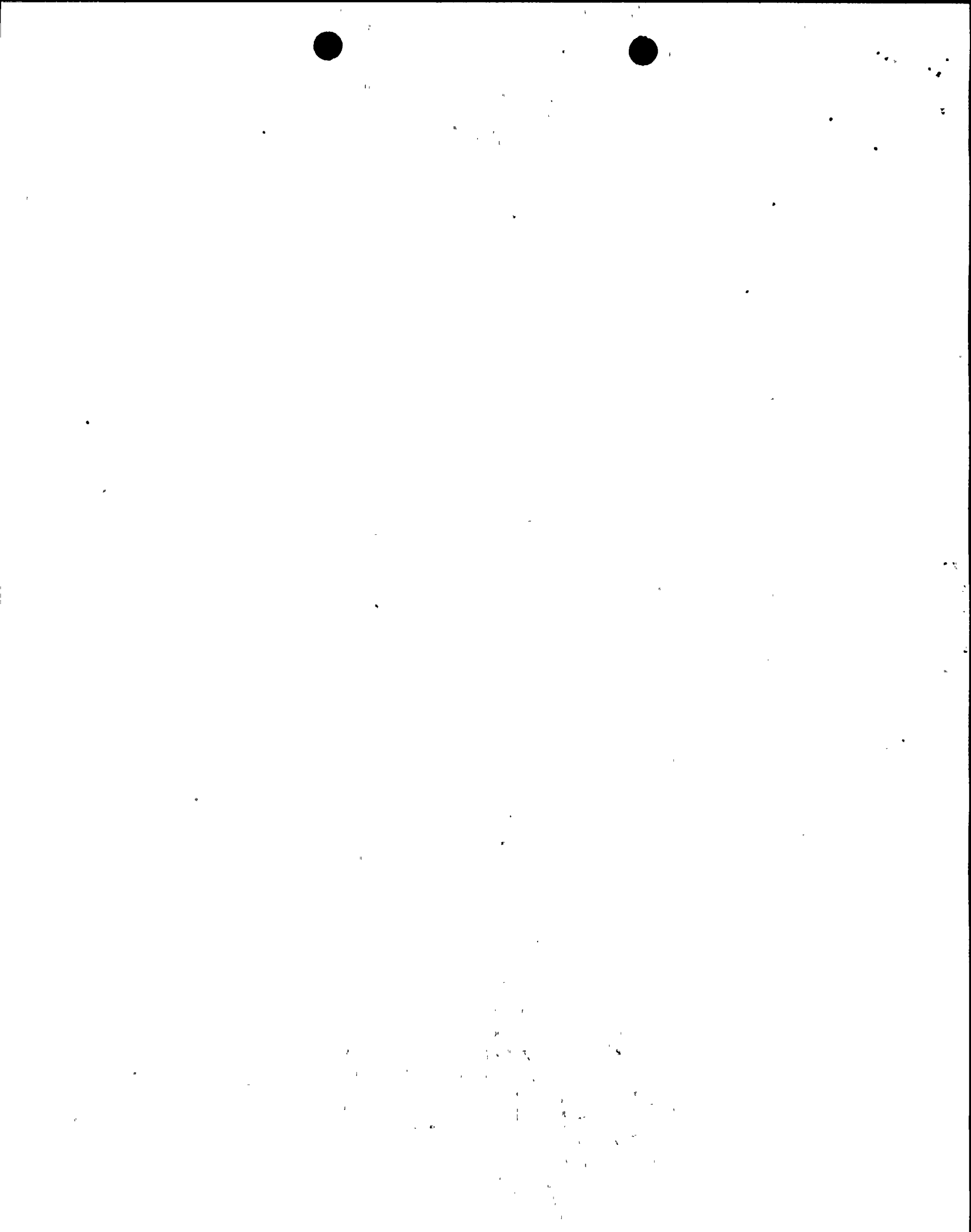
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Mr. Gregory M. Rueger

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June 23, 1998

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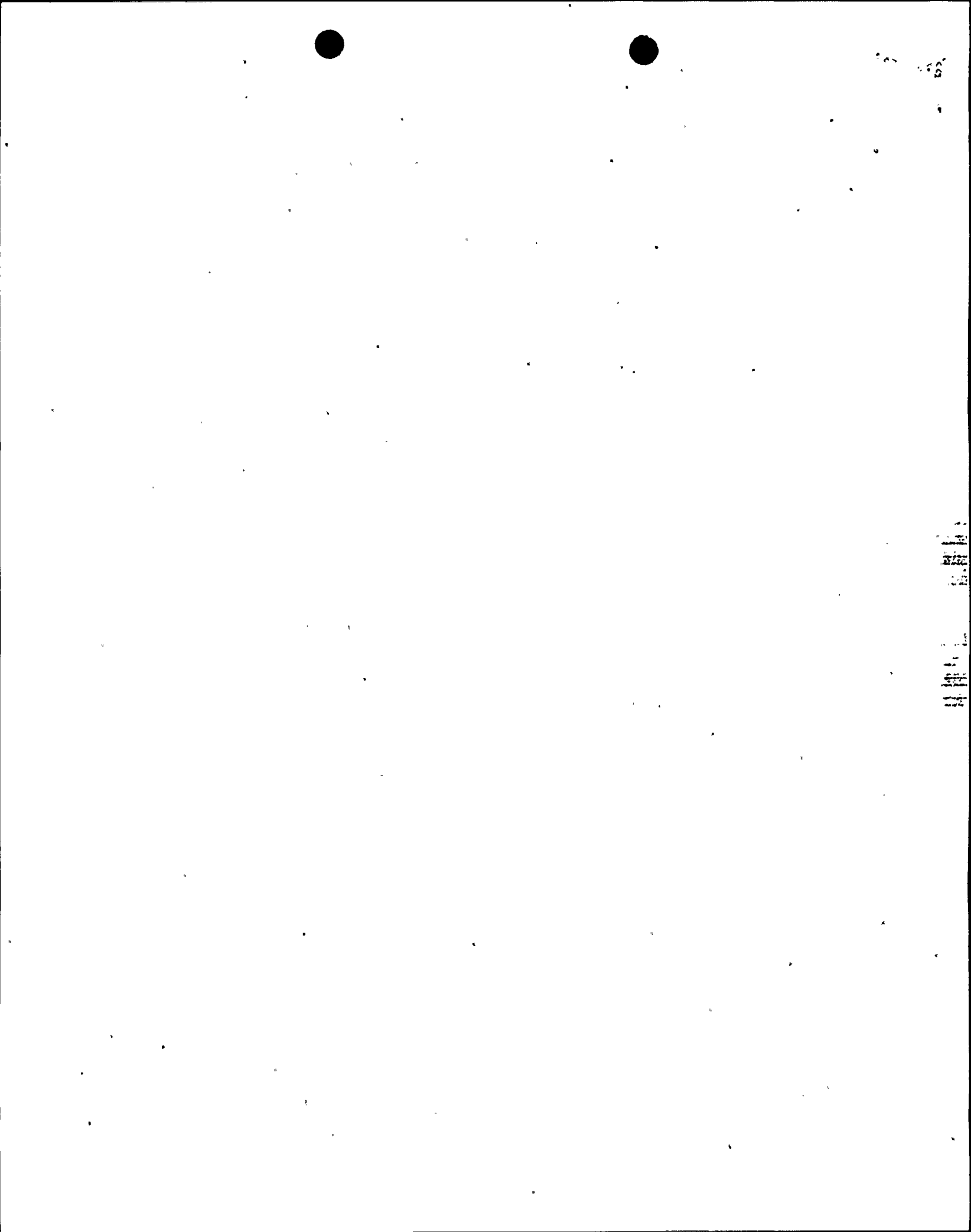
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REQUEST FOR ADDITIONAL INFORMATION

PACIFIC GAS & ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-275 AND 50-323

1. Consistent with previous staff approval of alternate repair criteria (ARC) that rely, in part, on the integrity of the tube support plates (TSPs), provide the plans for secondary side inspections to ascertain the integrity of the steam generator (SG) internals (e.g., TSPs, stayrods, vertical support bars, and tube bundle wrapper).
2. If one considers that all TSPs are locked into position, discuss the implications related to the level of stress developed in the tubes at the top-of-the-tubesheet (TTS) under normal operating conditions, and its effect on degradation at that location.
3. The staff finds the limited and highly variable laboratory pull force test results discussed in WCAP-14707 difficult to interpret and generally not supportive of the Dampierre-1 pull force test results. For example, pull force measurements from the 7 laboratory samples ranged from 80 to 4200 lbs, and there is no apparent correlation with dent size. Additional pull force testing, at temperature, appears warranted to develop a more robust database, especially given the proposed broad application to all Model 51 SGs in the U.S.
4. WCAP-14707 and the licensee's response to the December 2, 1997, RAI do not demonstrate that the Dampierre-1 tube pull force results are directly applicable to U.S. Model 51 SGs. The staff requests that direct measurements of tube pull forces be made to demonstrate, on a Model 51-specific basis, that corrosion product buildup in the tube-to-TSP crevice can be relied upon to prevent TSP displacement during an MSLB event.
5. Confirm that each of the Dampierre-1 tube pull force measurements is the result of an independent force versus displacement test.
6. Force measurements taken during the NRC program to remove tubes from the replaced McGuire-1 SGs do not appear to support the conclusions of WCAP-14707. Although the replaced McGuire-1 SGs were Model D-2s, not Model 51s, the TSP configuration is similar in that both models had drilled hole TSPs that were fabricated from carbon steel. The NRC program report documented that once the tube was released from the tubesheet, essentially no additional force needed to be applied to remove the remaining tube sections. The staff believes that tube pull forces are typically measured and recorded as a matter of course in the routine removal of SG tubes at U.S. facilities. In PG&E's response to Question 5 of the December 2, 1997 RAI, no mention was made of this type of information. The staff requests the licensee obtain and evaluate, as appropriate, such tube pull force measurements.





7. WCAP-14707 does not provide enough data to reach a conclusion relative to the effects of chemical cleaning. The staff believes that plant response to chemical cleaning may vary widely. In addition, the chemical cleaning process is continually evolving to become more effective. The effects of chemical cleaning need to be addressed on a process- and plant-specific basis.
8. The staff finds the leak rate testing described in WCAP-14707 to be of limited value given its scope and intended purpose. For example, the nine laboratory leak rate tests performed were somewhat faulted (i.e., performing the denting process after developing the throughwall cracks), and the Dampierre-1 leak rate tests were not performed at accident conditions. Additional leak rate testing, at temperature, appears warranted to develop a more robust database.
9. The licensee stated in its October 4, 1996, letter that PG&E plans to apply the WCAP results when performing SG tube integrity analyses for Diablo Canyon Units 1 and 2 (in April 1997 and January 1998, respectively). Specifically, only crack lengths extending outside the TSPs were evaluated for potential burst during a postulated MSLB event. The staff requests PG&E provide the details of these analyses and a discussion of how these analyses lay within PG&E's current licensing basis.
10. Section 10, "TSP Stresses Under Dented Conditions" evaluates how changes in operating conditions between cold shutdown and full power operation effect tube to TSP loads and stresses in the TSPs and support structures. The WCAP stated that the stress analyses in Section 10 were partially completed and a revision to this report will be issued upon completion of the stress analyses. Provide a schedule for the revision to Section 10.
11. Provide the staff a brief description of and the schedule for upcoming submittals that will support an ARC amendment for primary water stress corrosion cracking (PWSCC) at TSP intersections. Include a justification for high priority review of the ARC-related submittals.
12. Provide the staff a description as to how the licensee plans to implement the conclusions of WCAP-14707 with respect to TSP motion under accident conditions.
13. Provide the staff a description as to how the licensee plans to implement the conclusions of WCAP-14707 with respect to accident leakage.

