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BLUME INTERNAL REVIEW (BIR):
INDEPENDENT INTERNAL REVIEW OF THE WORK DONE BY URS/BLUME ENGINEERS ON THE DIABLO CANYON NUCLEAR POWER PLANT

Final Report

September 1982

prepared for
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94106

prepared by
URS/John A. Blume & Associates, Engineers
130 Jessie Street (at New Montgomery)
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SUMMARY

URS/John A. Blume & Associates, Engineers (URS/Blume), conducted an independent internal review of its Hosgri-related civil-structural analysis and design work on Pacific Gas and Electric Company's (PG&E) Diablo Canyon Nuclear Power Plant (DCNPP) project. The purpose of the review was to establish that all analyses performed by URS/Blume and all structures and structural components designed by URS/Blume either explicitly meet the Hosgri criteria or can be brought into reconciliation with the Hosgri criteria through the application of appropriate judgment that is consonant with good engineering practice.

The scope of review included all structures or structural components of the DCNPP that were analyzed and/or designed by URS/Blume. The basic review was conducted by URS/Blume personnel who are experienced in seismic analysis but who had little or no involvement in the analysis or design of the specific structure or structural components reviewed. Evaluation of reviewer comments and resolution of the concerns implied by them was performed by URS/Blume personnel who were familiar with the analyses and structures. Rigorous procedures detailing the material to be reviewed and the conduct of the review were established for the project and were adhered to throughout the execution of the review.

A total of 150 review comments were made. These comments cover a broad range of topics and reflect the extent of the material reviewed as well as the complexity of seismic analysis. The report gives a description of the review comments and the steps taken to resolve issues raised by the comments.

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TABLES

APPENDIX

1. INTRODUCTION

URS/John A. Blume & Associates, Engineers (URS/Blume), has conducted an independent internal review of the structural work done by URS/Blume for the Diablo Canyon Nuclear Power Plant (DCNPP) project since its inception. In this review, originally termed the Independent Internal Review project (IIRP) and commonly referred to as the Blume Internal Review (BIR), particular attention was given to the work performed according to post-Hosgri criteria to ensure that in all aspects the structural work was done consistently and accurately.

The objectives of the BIR project were to establish either that the work done meets the revised seismic criteria based on the postulated Hosgri fault effects or that, with the application of appropriate judgments that are consonant with good engineering practice, the results of the work can be reconciled with the revised criteria and with as-built structures and structural components. When some implication of uncertainty in the seismic capacity of a structure or structural component was found, it was identified, described in detail, and brought to the attention of Pacific Gas and Electric Company (PG&E), along with an evaluation of its impact, and recommended corrective actions.

Review Staff

The review was conducted by URS/Blume personnel who were experienced in seismic analysis but had little or no involvement in the analysis or design of the specific structure or structural component reviewed. It should be noted that the reviewers had awareness of current standards, criteria, and technology while conducting the review of work done more than 10 years ago. In addition, specific quality assurance (QA) standards were applied to the BIR project, standards that were not in existence when much of the work reviewed was being done.

A Resource Group, consisting of URS/Blume engineers who had had extensive involvement in URS/Blume work for PG&E on the DCNPP, provided any necessary basic information to the personnel conducting the review. All work performed on the BIR project was reviewed by an Advisory Committee of four

senior URS/Blume engineers. That committee was consulted on all matters that involved the use of engineering judgment, including the reconciliation of work that does not specifically meet the Hosgri criteria.

The BIR project was independent of any other ongoing verification project for the DCNPP being conducted by either URS/Blume or PG&E. The reviewers maintained minimal contact with the Resource Group and with others who had analyzed the DCNPP structures. Because of this, it is quite possible that the BIR project reviewers' concerns were being treated by other current verification projects as well. However, the procedure does guarantee that the review of the existing files, reported here, was as unbiased as it would have been if conducted by an organization other than URS/Blume.

Review Schedule and Completion

Several factors affected the schedule for completing the BIR project, as well as the manner in which the project was completed. The initial plan, developed in late January 1982, specified that the project be completed in one month and that month be February 1982. Project preliminaries -- including developing an agreed-upon scope of work, acquiring as-built drawings (about 2,000 drawings), and staffing this project -- took a substantial amount of time; the project was officially begun on February 22, 1982.

Early in March 1982, PG&E announced that it had engaged Bechtel Power Corporation (Bechtel) to assume the responsibility of Project Completion Manager for the DCNPP. In view of this additional resource, and to avoid duplication of effort between URS/Blume and the PG&E/Bechtel team, the date March 31, 1982, was established for completing the project. Concurrent with the decision to complete the project by that date, a change in scope was agreed upon with PG&E, shifting the major emphasis of the BIR project from identifying and evaluating discrepancies to primarily identifying discrepancies and identifying areas where the review was to be completed. Areas where the review was not completed are identified in other sections of this chapter and are summarized in Chapter 3.

Scope of Review

The BIR project addressed the seismic analysis and (where appropriate) design of 13 structures and structural components of the DCNPP. Structures and structural components of Units 1 and 2 of the DCNPP were reviewed as follows:

Structure/Component	Unit Reviewed
Containment interior	Unit 1 was reviewed in detail. Unit 2 was scanned, and, considering the approximations of the mathematical model, the seismic analysis for Unit 1 was judged to also apply to Unit 2.
Containment exterior shell	Units 1 and 2 were reviewed.
Auxiliary building	The auxiliary building is one structure serving both units; the entire structure was reviewed. Equipment weights for locations south of line 20 (applicable to Unit 2) were not reviewed.
Turbine building	Structural drawings for both units were reviewed. Only Unit 1 equipment-weight drawings were reviewed (equipment-weight drawings for Unit 2 were not reviewed).
Turbine pedestal	Unit 1 was reviewed.
Intake structure	One intake structure services both units; the entire structure was reviewed.
Outdoor storage tanks (two refueling water storage tanks, one fire water and transfer tank, and two condensate tanks)	The fire water and transfer tank and the Unit 1 refueling water storage and condensate tanks were reviewed.

Polar crane in the containment structure	The Unit 1 crane structure was reviewed.
Overhead bridge crane in the turbine building	The Unit 1 crane structure was reviewed.
Overhead bridge crane in the fuel-handling building	The one crane for Units 1 and 2 was reviewed for structural adequacy.
Gantry crane at the intake structure	The one crane for Units 1 and 2 was reviewed for structural adequacy.
Diesel-fuel-oil pump vault and trenches	Vaults for both Unit 1 and Unit 2, located at turbine building line 10-6, were reviewed.
G-line main steam and feed-water piping anchor, attached to the auxiliary building	The Unit 1 anchor was reviewed.

Only civil-structural analysis and design work done on the DCNPP was reviewed. The effect of possible response spectrum variations on equipment and piping analysis work was excluded from the scope of work. At the time the BIR project was being executed, various items of seismic analysis work at URS/ Blume were being performed. Because this work was not yet completed, it was excluded from the scope of BIR project work.

For each of the structures, the BIR project addressed the following tasks in reviewing the seismic analysis and design work done for the DCNPP by URS/Blume:

Task 1: Criteria

A Identification of actual criteria used for final analysis or design

B Comparison of actual criteria used with Hosgri criteria

Task 2: Mathematical Modeling for Analysis

A Identification of actual mathematical model used for final seismic analysis

B Identification of as-built structure configuration and associated weights

C Comparison of actual mathematical model used with as-built structure characteristics

Task 3: Computer Programs Used for Analysis

A Identification of all computer programs used for final analysis and/or design

B Identification of QA verification status of all computer runs used for final analysis and/or design

Task 4: Seismic Analysis Using Mathematical Model

A Comparison of actual seismic demand input used for analysis with criteria requirements

B Evaluation of methodology and results of seismic analysis

Task 5: Results of Analysis

A Identification of final documents summarizing analysis results

B Comparison of computer output results with values in final documents

Task 6: Seismic Analysis Results Used for Design

A Identification of seismic analysis results used for design

B Evaluation of how seismic analysis results were used for design

Task 7: URS/Blume Design Work

A Evaluation of methodology and results of design calculations

B Comparison of design calculations with final design documents

C Comparison of as-built design drawings with final design documents

Project Procedures

The BIR project was conducted by a special task force and was led by a project manager, all of whom were selected by the president of URS/Blume. The president was ultimately responsible for approval of all of the documents generated during this project. PG&E was informed of all project

procedures, progress, and findings at weekly progress meetings attended by the URS/Blume project manager and the PG&E interface engineer.

The review was performed by following the Criteria and Instructions document prepared for this project (PROC-8216-03). Certain tasks detailed in PROC-8216-03 were not performed because necessary information was not available at the time of the review. Specifically, task 6A, identification of seismic analysis results used for design, and task 6B, evaluation of how seismic analysis results were used for design, were not performed for the structures designed by PG&E.

All of the materials necessary for BIR project tasks were obtained from either PG&E or URS/Blume files. A PG&E interface engineer and a URS/Blume project coordinator handled communications between the two companies.

The basic approach used for the BIR project was to start with each of the final reports issued (References 1 to 12) and work backward to verify all of the information they contained, following the guidelines of PROC-8216-03. Emphasis was placed on comparing as-built conditions with those used in the reviewed analyses and designs. The review of each of the structures and structural components considered was documented in accordance with the outline recommended in PROC-8216-03, and 13 review packages (one for each structure or structural component reviewed) are included as part of the BIR project files.

In instances where the reviewer judged (1) that the reliability of the analysis could not be determined because of inadequate documentation, or (2) that deviations from good engineering practice existed, or (3) that discrepancies were found, the following actions were taken:

- A statement of the problem was noted.
- Recommedations of corrective actions were made.
- The project manager reviewed the problem.
- The Advisory Committee reviewed the problem to make its own independent evaluation and recommendations, placing specific emphasis on the adequacy of the existing structures.

- PG&E was notified of the problem, its expected impact, the recommended corrective action, and the Advisory Committee's evaluation.

Procedurally, the reviewers entered their comments and recommended corrective actions on a review comment form. (See Appendix for sample review comment form.) They commented on anything about the work that concerned them -- questions about its technical accuracy, lack of documentation, any difficulty in understanding available documentation, etc. The project manager reviewed the form and then forwarded it to the Advisory Committee. The committee met regularly to address the comments. The PG&E interface engineer attended all committee meetings. The appropriate reviewer participated in the meeting when more information than was supplied on the comment form was required. After it had been evaluated by the Advisory Committee, the comment form was signed by the committee chairman and transmitted to the PG&E interface engineer. The signatures of the PG&E interface engineer and the URS/Blume project coordinator on the comment form indicate proper transmission of the comment and PG&E's understanding of the comment and the recommended corrective action.

The procedure used to process the reviewers' comments is described in the project QA review document (PROC-8216-02), which is included in the BIR project files. A log of these comments was maintained, as required by PROC-8216-02, and is also included in the BIR project files.

Subsequent to PG&E's receipt of the BIR review comment forms, PG&E's Blume Internal Review Evaluation Committee (BIREC) evaluated them. BIREC was created to provide PG&E with an opportunity for evaluating the review comments to determine the most appropriate manner in which they should be resolved. Accordingly, BIREC recommended the manner of resolution and specified the organization (PG&E, URS/Blume, or others) to perform the resolution work. These recommendations were made on a separate BIREC form (see Appendix for a sample form) generated for each BIR review comment. In addition, review comments judged by BIREC to imply possible nonconformance with design criteria were included in PG&E's Open Item system for tracking the resolution of noted discrepancies.

Final resolution work for those items assigned by BIREC to URS/Blume was generally performed by the URS/Blume department initially involved in the analysis. A summary of the results of the resolution work for each review comment was documented on still another separate form. These forms are designated the Blume Internal Review Resolution (BIRR) forms; an example form is included in the Appendix. For those items assigned by BIREC to PG&E, the BIRR form was completed by URS/Blume upon receipt of notification from PG&E that the resolution work had been completed.

During the resolution phase of this project, the PG&E/Bechtel program became more all-encompassing with regard to the DCNPP, and URS/Blume and others were directed to perform reanalyses of complete structures or components. Because of this, resolution of some BIR comments would have been irrelevant, and resolution was no longer warranted. The closure for these items, for the BIR project, is simply that the items were referred to the PG&E/Bechtel project for resolution.

2. REVIEW FINDINGS

The BIR project reviewers made a total of 150 review comments. Table 1 is a summary log of the comments. The table gives a brief description of each comment, provides a characterization of the comment, shows the corrective action taken to resolve the comment, and indicates the impact of the noted discrepancy on DCNPP seismic performance.

The 150 review comments individually address a broad range of topics and indeed reflect the extent of the material reviewed and the complexity of seismic analysis. To provide perspective, the comments were characterized and grouped into five categories, as follows:

> Reviewer Interpretation (RI): Review comments that were judged by peer review to be insignificant or irrelevant.
>
> Quality Assurance (QA): Review comments involving needed clarification of calculation files, augmentation of calculation files, or verification of computer programs.
>
> Typographical: Review comments alluding to typographical errors in final reports reviewed.
>
> Modeling: Review comments alluding to discrepancies noted regarding as-built drawings vis-a-vis mathematical models, and mathematical-modeling assumptions.
>
> IIRP Project Control (PC): Review comments generated for the purpose of indicating where reviews were not performed.

Review comments for which the corrective action is designated in Table 1 with a triple asterisk (***) are items being resolved by others. Review comments for which the corrective action is designated with a cross (†) are items that no longer warrant resolution because the PG&E/Bechtel verification reanalyses supersede them and would render resolution of the comment irrelevant.

Upon completion of the resolution of the various review comments, an evaluation of the impact of the discrepancy on DCNPP seismic performance was made. These impact evaluations were categorized as follows:

None: Resolution of the review comment required no changes to analysis or design of the structures.

Insignificant: Resolution of the review comment resulted in a minor change, but analysis or design results, as they affected the structures, still fulfill the requirements of applicable design criteria.

Significant: Resolution of the review comment showed that analysis or design results do not fulfill the requirements of applicable design criteria.

**: Seismic analysis resolution is complete, but impact on DCNPP seismic performance must be determined by designer; or resolution is being made by others, with impact to be determined under the PG&E/Bechtel project.

†: Review comment was not resolved as part of this project because it is superseded by, and is being resolved as part of, the PG&E/Bechtel project.

TABLE 1

REVIEW COMMENT SUMMARY LOG

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
Auxiliary Building				
AB001	The number of modes listed in the final report does not reflect the actual number of modes used in the analysis.	QA	Calculation files and report revised	None
AB002	Typographical error on page 10 of final report (5% eccentricity should be 7%).	Typographical	Report revised	None
AB003	A 10% increase in horizontal response was used to approximate torsional response at node 6. Increase was correctly used for spectra at El 188' but was not included for displacements, accelerations, shears, etc. tabulated in final report.	QA	Report revised	**
AB004	Fuel-Handling Building crane input considered effects of geometric eccentricity of Auxiliary Building, but not the effects of accidental torsion of the FHB.	QA	None	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
AB005	Hosgri criteria document shows a 24-sec-duration acceleration time history, while the analysis used only the first 20 sec.	QA	Calculation files and report revised	None
AB006	QA verification status of several programs is unknown since runs were made prior to signoff date by checker but after signoff date by originator.	QA	†	†
AB007	Mathematical model presented in Figure 12 of final report is misleading. Figure is a schematic representation of the more complex computer model.	QA	Calculation files and report revised	None
AB008	Values of f'_c and E_c used in DYBOX program are not consistent with the actual material properties used in the analysis.	RI	None	None
AB009	Extra calculation sections were later added to the previously bound and quality-assured calculation files without complete QA documentation.	QA	Calculation files revised	None
AB010	Building mathematical model properties (other than the mass values) were obtained from PG&E SHEARWAL program, in which previous errors were discovered for the output mass values. PG&E should verify that no errors exist in the other output used for the mathematical model.	Modeling	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
AB011	Mass point elevation locations representing the roof of the FHB at El 188' are different for each of the three separate mathematical models used for analysis.	RI	None	Insignificant
AB012	Mathematical model properties used for the vertical analysis are not consistent with those used for the translational model.	Modeling	†	†
AB013	Reported E/W response results did not include the codirectional response caused by the vertical input component.	QA	†	†
AB014	E_c values should be measured from concrete test results instead of usage of the ACI formula.	RI	None	None
AB015	The procedure for smoothing of floor response spectra in the Hosgri criteria is unclear.	QA	Calculation files revised	None
AB016	The mass of the water in the spent-fuel pool should consider the impulsive and convective effects of the water.	Modeling	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
AB017	Unit 2 Auxiliary Building equipment layout drawings were not received. Weight discrepancies are expected.	Modeling	†	†
AB018	In Figures 2, 3, & 4 of final report, sketches locating Auxiliary Building columns relative to the centerline of the containment are misleading since a physical gap exists.	RI	None	None
AB019	Selected results from all four possible accidental eccentricity cases were reported. It is not clear whether these represent an envelope.	QA	†	†
AB020	Auxiliary Building model used for analysis was a simplistic lumped-mass model, which would not be used if analysis were done today because of the building layout.	RI	None	None
AB021	Soil springs require further review.	Modeling	†	†
AB022	Control room slab analysis needs further review.	PC	None	None
AB023	Live loading not considered in analysis of control room slab.	Modeling	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
AB024	The vertical flexibility of critical floor slabs must be checked considering the actual live-load conditions.	Modeling	†	†
Containment Polar Crane				
CC001	Member torsional moments of inertia are incorrect.	QA	Calculation files revised	Insignificant
CC002	Gap element subroutine has not been verified. ANSR verification package has not been approved.	QA	†	†
CC003	Selection of spring stiffness of 4,000 k/in for gap element was apparently arbitrary.	QA	†	†
CC004	Evaluation of cable stresses has not been included in final report.	QA	†	†
CC005	Stress ratios exceed 1.0 at several locations, based on minimum yield stress of Fy = 36 ksi.	QA	†	†
CC006	Torsional spectra were not considered as part of the input to the polar crane.	RI	None	Insignificant
CC007	Acceleration response spectra generated at top of polar crane are incorrect. Time-history input used to generate spectra utilized relative acceleration instead of absolute acceleration responses of polar crane model.	QA	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
Containment Exterior				
CE001	There is no documentation for shear-wave velocities in the May 1979 report.	QA	Calculation files revised	None
CE002	There is no listing of the time history in the Hosgri criteria with which to compare actual time histories used.	RI	None	None
CE003	Axisymmetric model ignores 18' and 10' openings.	QA	Calculation files revised	None
CE004	Model underestimates total weight of structure by approximately 7%.	RI	None	Insignificant
CE005	ASHD-4 computer program not QA verified.	QA	Calculations verified	None
CE006	Values used for weak axis moment of inertia for horizontal members in the torsional model may be in error.	RI	None	None
CE007	Response spectrum used for vertical analysis does not exactly coincide with that listed in Hosgri criteria.	RI	None	None
CE008	Title of Table 5 "Max. shell forces" is misleading. Need to combine accidental torsional analysis to obtain final results.	QA	Report revised	None
CE009	Shell moments from the accidental torsional analysis have not been included in values listed in final report.	RI	None	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CE010	Response values in final report include effects of combining non-codirectional responses	QA	Calculation files revised	None
CE011	There are no calculations to document the axial forces listed in Table 9A of the final report.	QA	Calculation files and report revised	**
CE012	The effect of the 10-ft-high lean concrete core with asbestos liner was not considered in the analysis.	QA	Calculations verified	None
CE013	The sign of the moments is ignored in calculating the shear due to the change in moment over an element of the axisymmetric model.	RI	None	Insignificant
CE014	The wrong element length was used in the calculation of the shear due to the change in moment over an element of the axisymmetric model.	RI	None	Insignificant
CE015	Numerical error in scaling the torsional response at node 8 in computer runs 22 and 23.	QA	Calculation files revised	None
CE016	The number of modes listed in the final report does not reflect the actual number of modes used in the analysis.	QA	Calculation files and report revised	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CE017	Lack of documentation for the participation factors reported in the final report for the torsional model.	RI	None	None
CE018	As-built pipe masses supported on the shell are unknown. Mathematical model used for analysis did not include pipe masses.	RI	None	Insignificant
CE019	Time-history-generated spectra were not compared to non-time-history-generated representative spectra per requirements of section 5(B) of Hosgri criteria.	QA	Calculation files revised	None
CE020	Discrepancy in spectra combinations between manual hand calculations, computer calculations, and values listed in the final report.	QA	Calculation files revised	None
CE021	Generation of the vertical floor spectra is a lengthy, complicated procedure that should be checked.	QA	Calculations verified	Insignificant
CE022	A second torsional component was omitted in the determination of total response.	RI	None	None

(Continued)

TABLE I (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CE023	It appears that relative instead of absolute acceleration was used as input to generate vertical spectra (which was combined with other spectra to determine total spectra).	RI	None	None
CE024	Combination of responses from the translational and torsional models includes the effects of translation twice because the torsional model includes both translational and torsional responses.	RI	None	None
Containment Interior				
CI001	Computer output for the vertical analysis is missing.	QA	Calculation files and report revised	**
CI002	Discrepancy between the number of modes used in the analysis and those listed in the final report.	QA	Calculation files and report revised	None
CI003	Discrepancy between the node numbering used for the axisymmetric model presented in the final report and that used in the computer analysis.	QA	Calculation files revised	None
CI004	Discrepancy in equipment weights.	Modeling	†	†
CI005	No documentation for the mass and stiffness value for the axisymmetric model used for tranlational analysis.	Modeling	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CI006	Axisymmetric model not valid between El 114' and 140'. (Stiffnesses differ significantly for each horizontal direction.)	Modeling	None	None
CI007	No center of rigidity calculations relative to E-W axis to confirm CR location with respect to calculated CG.	QA	Calculations verified	None
CI008	Eccentricities used for accidental torsion are low by 75% based on use of maximum plan dimension at each level vs actual dimensions used.	RI	None	None
CI009	Four models are possible for the accidental eccentricity evaluation.	RI	None	None
CI010	All masses below El 127' were conservatively lumped at El 114' in mathematical model for torsional analysis.	RI	None	None
CI011	Stick model used for torsional analysis produces computer output results that are inconsistent.	RI	None	None
CI012	Maximum horizontal accelerations reported for nodes 19 (EL 140') and 27 (El 114') may not be maximum values based on maximum computer output displacement values for nodes 20 (El 140') and 30 (El 114').	RI	None	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CI013	Torsional accelerations reported are inconsistent with torsional moments reported.	RI	None	None
CI014	Shear values presented in Table 8 of final report are not maximum values (based on methodology discussed in report and applied to the computer analysis results).	QA	Calculations verified	None
CI015	Total shear values presented in Table 8 of final report could be incorrect depending on methodology for combining shear components.	QA	Calculations verified	Insignificant
CI016	Final report does not contain any analysis result information from which PG&E could design the reinforced concrete area located around the steam generators above El 140'.	QA	Calculations verified	None
CI017	Final report does not list the local bending moments in the crane wall and interior walls resulting from the analysis of the structure.	QA	***	**
CI018	Computer program QA verification not complete at the time the programs were used for analysis.	QA	Programs verified	Insignificant
CI019	Time-history-generated floor response spectra were not checked as required in Hosgri criteria by an alternate method.	QA	Calculation files revised	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
CI020	Floor spectra smoothing method (see AB015).	QA	Calculation files revised	None
CI021	Discrepancy exists between hand-calculated accidental torsional angular acceleration and that reported in final report.	RI	Calculations verified	None
Diesel Fuel Oil Vault				
DV001	Information transmitted from PG&E to URS/Blume was not included in the QA files.	QA	Project files revised	None
DV002	Trench covers near vault covers should also be designed for H-20 wheel loads.	QA	Calculation files revised	None
Fuel-Handling Crane				
FC001	Member properties for the crane rail girder are incorrect for east and west walls.	Modeling	†	†
FC002	Building model used in the crane analysis does not agree with PG&E drawings.	Modeling	†	†
FC003	Final report made no mention of evaluation of cable stresses.	QA	†	†
FC004	Input to crane analysis did not consider accidental eccentricity.	QA	None	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
Intake Structure Crane				
IC001	Effect of torsion not taken into account in original analysis.	QA	Calculation files revised	Insignificant
IC002	Evaluation of cable stresses not included in final report.	QA	Calculation files revised	Insignificant
Intake Structure				
IS001	The effect of the crane support reactions on local stress conditions should be assessed.	QA	***	**
IS002	Minor differences between the model and structure exist. The calculation of local stresses (around openings, etc.) may not be accurate.	QA	***	**
IS003	Slight discrepancy between the spectrum used for the analysis and that contained in the Hosgri criteria.	QA	None	Insignificant
IS004	Out-of-plane components were neglected when calculating the residual modal forces for frequencies above 33 Hz.	QA	Calculation files revised	None
IS005	Vertical uplift inertial force calculated in stability calculations utilized the submerged structure weight instead of the real weight in air.	Modeling	Calculation files revised	Insignificant
IS006	Generated floor spectra did not match the ground spectra for periods less than 0.1 sec as indicated in the final report.	QA	Calculation files and report revised	Insignificant

(continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
IS007	Various live loads were not considered in the analysis of the structure	Typographical	Report revised	None
IS008	Tsunami (water-wave) effects (hydrodynamic loading) were not considered in the analysis of the Intake Structure walls.	QA	***	**
IS009	No QA verification documentation exists for Programs SAP IV (version 3), FORCE, COMBINE, or TEST that were used for analysis in 1979.	QA	†	†
IS010	Ventilation shafts above auxiliary salt water pumps were not analyzed.	QA	†	†
IS011	The development length of the rebars in some of the seaward flow straighteners into the base slab may not have been properly calculated.	RI	None	None
G-Line Main Steam Anchor				
MS001	Full fixity at the anchor is in doubt due to 1/16" gap.	Modeling	***	**
MS002	The yield stress of the lug and saddle plate is in doubt.	QA	***	**

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
MS003	The weld connecting the lug to saddle plate called out by the engineer is different from the as-built weld.	QA	***	**
MS004	There appears to be an insufficient amount of weld connecting saddle plate to pipe.	QA	***	**
MS005	Independent Internal Review did not cover Tasks 1 through 4.	PC	***	**
Outdoor Storage Tanks				
ST001	Concrete strength f'_c used for analysis was 3 ksi, whereas 4 ksi was used for design and as-built construction. E_c therefore increases 12.0%, and frequencies of response increase 5.8%.	QA	Calculation files revised	Insignificant
ST002	The thickness of the reinforced concrete shell surrounding steel tanks used for analysis was less than that used for as-built construction. Added mass is only 5% of the total full weight of the tank. The calculated frequency of response will also change.	Modeling	None	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
Turbine Building				
TB001	Lack of documentation (both descriptive and computer analysis) for the generation of the floor response spectra presented in the final report (E-W direction).	QA	Calculations verified	Insignificant
TB002	Runs of SAP-IV do not meet criteria — frequencies do not go to the rigid range.	QA	Calculation files revised	†
TB003	Run 4.3 is mislabeled in the index and on the run.	QA	Calculation files revised	None
TB004	Tabulated maximum response values in the design calculations for Newmark-Hosgri and Blume-Hosgri are exceeded by E-W analysis in computer files.	QA	Calculation files revised	†
TB005	Buttress walls along column line A, El 85' to 119', Unit 2 were modified to accommodate Technical Support Center in 1980-81. Impact on analysis was not evaluated.	Modeling	Calculation files revised	Insignificant
TB006	Figure 6 of final report labeled incorrectly as typical section.	RI	None	None

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
TB007	50% of steel columns along column lines A and G were strengthened by adding bars to flanges and web stiffeners above and below El 140'. Increase in stiffness not considered in previous analysis.	Modeling	Calculation files revised	Insignificant
TB008	Input data to MATRAN program used to generate floor spectra cannot be verified since input data is not echoed in output results.	QA	Calculations verified	Insignificant
TB009	10% increase in translational response used to account for accidental torsion in the building analysis was not used in generating the floor spectra.	QA	Calculation files and report revised	**
TB010	Inconsistencies in the development of "equivalent" column properties to represent intersecting walls.	Modeling	Calculation files revised	Insignificant
TB011	Input spectra error in the E-W analysis: 0.024 sec was input instead of 0.24 sec.	QA	None	None
TB012	Drawings were not consistently updated when revised to reflect as-built conditions.	Modeling	Drawing updated	None
TB013	Analytical models were neither changed nor impact studies performed to incorporate changes from preliminary to final designs and field changes.	QA	Calculation files revised	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
TB014	Beam and 1/2"-thick checker plate element of mathematical model used input values 50% larger than calculated and no design check was performed for possible plate buckling.	Modeling	Calculation files revised	Insignificant
TB015	Many of the computer analysis runs do not echo the input data, thereby making it impossible to readily verify the input parameters.	QA	Computer files verified	Insignificant
TB016	Modifications and additions to the diaphragms at El 104' and 119' between the buttresses for the Condensate Polishing System were not evaluated for impact on analysis and design.	Modeling	Calculation files revised	Insignificant
TB017	Frequencies considered in the analysis for generating floor response spectra at El 119' did not go up to the rigid range.	RI	None	None
TB018	Two different methods have been used to evaluate the adequacy of different structural members.	QA	†	†
TB019	QA procedures for checking should be used.	QA	Calculation files reviewed and †	†
TB020	Spectra contained in the final report do not consider as-built changes to the structures.	Modeling	†	†

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
TB021	No documentation exists to justify the use of 80 ksf as the allowable bearing pressure on the soil underneath the structure foundations.	QA	Calculation files revised	None
TB022	Models used in analysis, in general, did not allow for cross coupling effects of the 3-directional earthquake.	RI	None	None
TB023	Model used a 50 psf distributed equipment weight in addition to individual equipment values.	RI	None	None
TB024	Weld designation on drawing needs clarification.	RI	None	None
TB025	Structural steel columns were used to determine shear capacity of reinforced concrete shear walls.	RI	None	None
TB026	A reduced shear area (5/6 of wall area) was used for design.	RI	None	None
TB027	No documentation that field changes in #9 rebars at columns were reviewed for accuracy.	QA	Calculations verified	Insignificant
TB028	Assumption of a rigid foundation for the Turbine Building mathematical model not verified.	RI	None	None
TB029	Computer programs were modified prior to final use for analysis and were never quality assured.	QA	Programs verified	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact of DCNPP Seismic Performance
TB030	Conflicting location of 1'-4"-thick wall shown on different drawings.	Modeling	Drawings updated	None
TB031	No calculations exist to justify the design of the stiffener plates used for the checker plate diaphragm.	Modeling	Calculation files revised	None
TB032	Changes made to accommodate the Condensate Polishing System were not evaluated for impact on analysis	Modeling	Calculation files revised	Insignificant
Turbine Building Crane				
TC001	Cross-sectional area of concrete walls used in building model to determine crane input underestimated by 30%.	Modeling	None	Insignificant
TC002	Accidental torsion input not included in analysis.	QA	Report revised	None
TC003	Scalar factors used to reduce crane response in N-S direction are incorrect. Maximum stress ratio exceeds 1.0 for f_y = 36 ksi but can be reduced below 1.0 by using mill test material strength results.	QA	Calculation file revised	None
TC004	Evaluation of cable stresses not included in final report for the loaded crane analysis.	QA	Calculation file revised	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
TC005	Vertical time-history response at El. 180' of bridge girder supports is incorrect since mathematical model did not include cross-bracing members or concrete shear walls.	RI	None	Insignificant
Turbine Pedestal				
TP001	Ultimate strength capacity reduction factors (Øs) used in design were assumed to be equal to unity, whereas the ACI 318-71 code values are less than unity.	QA	Calculation files revised	None
TP002	Mathematical model element #116 sectionproperties used for analysis were 100 times less than what should have been used.	QA	Calculation files revised	None
TP003	As-built vertical locations of CG's of Turbine and Generator are at least 6' higher (more like 10') in elevation than what was used in the mathematical model for analysis.	Modeling	Calculations verified	None
TP004	Total forces and moments used for member design were applied only in one direction at a time.	QA	Calculations verified	None
TP005	Members loaded with flexural and compression loads were not checked for this load combination.	QA	Calculation files revised	Insignificant

(Continued)

TABLE 1 (Continued)

Review Comment Number	Description	Characterization	Corrective Action	Impact on DCNPP Seismic Performance
TP006	#18 bars were spliced and bundled, and ACI-318-71 code does not allow splicing above size #11.	QA	†	†
TP007	Cannot verify adequacy of transfer of output data from one program run that was used as input to another.	QA	Calculation files verified	None
TP008	Prestressing force of pedestal columns was ignored in foundation mat design check.	QA	Calculation files revised	Insignificant
TP009	Mat design checks do not include all strips.	QA	Calculation files revised	Insignificant
TP010	Source of the 80 ksf allowable soil bearing pressure used for design cannot be identified.	QA	Calculation files revised	None
TP011	Design review not completed.	QA	†	†

3. SUMMARY OF REVIEW FINDINGS

Table 2 is a summary of the BIR review comments. The table summarizes the resolution status of the review comments for each structure and the impact on DCNPP seismic performance. In addition, the table shows the PG&E Open Item system numbers used for tracking the resolution of the various review comment items. A description of the impact categories is given in Chapter 2.

The review of seismic analysis and design work that could not be completed by March 31, 1982, is summarized as follows:

1. Tasks 6A and 6B as specified in the Criteria and Instructions document developed for the BIR project (PROC-8216-03, Rev. 2, 5-12-82, also identified as items 2.15 and 2.16 in URS/Blume's February 9, 1982, proposed Scope of Work) were not completed for the following structures or components: containment interior structure, containment exterior structure, intake structure, and auxiliary building. These tasks involve detailed discussion between seismic analysts and designers to ensure that the seismic analysis results were interpreted properly for design purposes.

2. Tasks 1 through 4 of the Criteria and Instructions document developed for the BIR project were not completed for the G-Line main steam and feedwater piping anchor, attached to the auxiliary building.

3. Unit 2 was not reviewed in some cases, as indicated in Chapter 1 under the heading Scope of Review.

TABLE 2

REVIEW COMMENT SUMMARY

Structure/Component	Total Number of Comments	Impact on DCNPP Seismic Performance (Number of Comments) None	Insignificant	Analysis Resolved**	Resolution by PG&E/Bechtel Project†	PG&E Open Item Numbers
Auxiliary Building	24	12	1	1	10	23,26,32
Containment Crane	7	--	2	--	5	19
Containment Exterior	24	18	5	1	--	--
Containment Interior	21	15	2	2	2	23,25
Diesel Fuel Oil Vault	2	2	--	--	--	--
Fuel Handling Crane	4	--	1	--	3	32
Intake Structure Crane	2	--	2	--	--	27
Intake Structure	11	3	3	3	2	23,27
G-Line Main Steam Anchor	5	--	--	5	--	31
Outdoor Storage Tanks	2	--	2	--	--	--
Turbine Building	32	14	12	1	5	23
Turbine Building Crane	5	2	3	--	--	24
Turbine Pedestal	11	6	3	--	2	23,24
Total	150	72	36	13	29	

**Seismic analysis resolution complete, but impact on DCNPP seismic performance must be determined by designer.

†Review comments that are being resolved under the PG&E/Bechtel DCNPP Verification Reanalysis Project.

REFERENCES

1. URS/John A. Blume and Associates, Engineers, *Diablo Canyon Nuclear Power Plant, Containment Structure Dynamic Analysis for the 7.5M Hosgri Earthquake*, San Francisco, May 1979.

2. _____, *Diablo Canyon Nuclear Power Plant, Auxiliary Building Dynamic Seismic Analysis for the 7.5M Hosgri Earthquake*, October 1979.

3. _____, *Diablo Canyon Nuclear Power Plant, Turbine Building Evaluation and Structural Modifications for the 7.5M Hosgri Earthquake*, March 1980.

4. _____, *Diablo Canyon Nuclear Power Plant, Turbine Pedestal Evaluation for the 7.5M Hosgri Earthquake*, March 1980.

5. _____, *Diablo Canyon Nuclear Power Plant, Intake Structure Dynamic Seismic Analysis for the 7.5M Hosgri Earthquake*, May 1979.

6. _____, *Diablo Canyon Nuclear Power Plant, Outdoor Water Storage Tanks Dynamic Seismic Analyses for the 7.5M Hosgri Criteria* (Revised), March 1979.

7. _____, *Diablo Canyon Nuclear Power Plant, Containment Polar Cranes Evaluation for the 7.5M Hosgri Earthquake*, July 1979.

8. _____, *Diablo Canyon Nuclear Power Plant, Response Spectra Generated at Top of Containment Polar Cranes for the 7.5M Hosgri Earthquake*, March 1980.

9. _____, *Diablo Canyon Nuclear Power Plant, Turbine Building Crane Evaluation for the 7.5M Hosgri Earthquake* (Revised), November 1979.

10. _____, *Diablo Canyon Nuclear Power Plant, Fuel-Handling Building Crane Evaluation for the 7.5M Hosgri Earthquake* (Revised), August 1979.

11. _____, *Diablo Canyon Nuclear Power Plant, Intake Structure Crane Evaluation for the 7.5M Hosgri Earthquake* (Revised), November 1979.

12. _____, *Diablo Canyon Nuclear Power Plant, G-Line Anchors Evaluation for the 7.5M Hosgri Earthquake*, March 1979.

13. Harding-Lawson Associates, "Fuel-Oil Pump Vaults--Earth Pressure," Novato, California, March 1978 (received February 22, 1978, from Pacific Gas and Electric Company).

APPENDIX

Example REVIEW COMMENT, EVALUATION, and RESOLUTION Forms

"REVIEW COMMENT" FORM
DIABLO CANYON NUCLEAR POWER PLANT
INDEPENDENT INTERNAL REVIEW PROJECT

CLIENT : PG&E
JOB NO.: 8216

Review Comment Number _____ for the _____

INITIATION--Description of Comment:

Recommended Corrective Action:

_____ Reviewer _____ Date

Project Manager's Comments:

_____ Project Manager _____ Date

EVALUATION--Advisory Committee's Comments:

_____ Advisory Committee - Chairman _____ Date

INTERFACE ACKNOWLEDGMENT:

_____ URS/BLUME Project Coordinator _____ Date _____ PG&E Interface Engineer _____ Date

URS/Blume

PROC-8216-02
Rev. 0, 3-1-82

Rev. 0: 3-31-82
1: 4-2-82
2: 4-9-82

BIREC "Disposition-Form" of BIR Review Comments

BIR Review Comment #_____ Structure/Component _____

PG&E Comments:

PGandE BIREC Chairman: Date:

BIR Response:

BIR Advisory Committee Chairman: Date:

Disposition:

PGandE BIREC Chairman: Date:

URS/Blume

Revision 0

Form 8234-1

BIR RESOLUTION PROJECT

DISPOSITION FORM

BIR Review Comment #_____Structure/Component_____

Description of Comment:

Corrective Action:

Approved by:_____
Project Manager

Date:_____

URS/Blume

DOCUMENT TITLE: *Final Report of Blume Internal Review: Independent Internal Review of the Work Done by URS/Blume Engineers on the Diablo Canyon Nuclear Power Plant*

DOCUMENT TYPE: Criteria ☐ Interface ☐ Report ☒ Specification ☐ Other ☐

PROJECT NAME: Diablo Canyon Nuclear Power Plant Independent Internal Review Project

JOB NUMBER: 8216

CLIENT: Pacific Gas and Electric Company

DOCUMENT NUMBER: REPORT-8216-01

* * * * *

This document has been prepared in accordance with the URS/Blume *Quality Assurance Manual*, Revision 8, including QA revisions in Record of Personal Conversation, April 1, 1982 (Correspondence Log item #94), and project requirements. Initial issue (Rev. 0: September 1982).

Prepared by: _____ Date: 9/30/82

Reviewed by: _____ Date: 9/30/82

Approved by: _____ Date: 9/30/82

REVISION RECORD:

Revision No.	Prepared By	Reviewed By	Approved By/ Date	Description of Revision

URS/Blume

APPENDIX 1C

APPENDIX 1C
RESOLUTION OF
A OR B ERRORS IDENTIFIED BY THE IDVP

EOI FILE NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF PROPOSED PROJECT RESOLUTION	PROPOSED RESOLUTION STATEMENT	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS PER IDVP (1)	CAUSE CATEGORY (2)
932	FOR THE PURPOSE OF SEISMIC PIPE ANALYSIS, SUPPORT 58S-23R WAS ASSUMED TO BE RIGID, I.E., RESTRAINING PIPE MOVEMENT, IN THE VERTICAL UPWARD DIRECTION. HOWEVER, FIELD INSPECTION SHOWED THE SUPPORT DID NOT RESTRAIN THE PIPE IN THE VERTICAL UPWARD DIRECTION. THE SUPPORT HAS BEEN MODIFIED TO RESTRAIN PIPE MOVEMENT IN THE VERTICAL UPWARD DIRECTION.		THE SUPPORT HAS BEEN MODIFIED TO RESTRAIN PIPE MOVEMENT IN THE VERTICAL UPWARD	SECTION 2.2.1 2.2.1.3.2.1	A	1
949	THE ORIGINAL SEISMIC ANALYSIS OF THE MAIN ANNUNCIATOR CABINET WAS MADE USING THE ASSUMPTION THAT THIS CABINET WAS RIGID IN THE SIDE-TO-SIDE DIRECTION. SINCE THE RIGIDITY IN THIS DIRECTION CANNOT BE ACCURATELY VERIFIED, THIS ASSUMPTION WAS QUESTIONED.	THE MAIN ANNUNCIATOR CABINET HAS BEEN REANALYZED AND MODIFICATIONS HAVE BEEN DESIGNED TO PROVIDE SIDE-TO-SIDE RIGIDITY.	SEISMIC QUALIFICATION OF ELECTRICAL COMPONENTS IS UNAFFECTED.	SECTION 2.3	A OR B	3

EDI FILE NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF PROPOSED PROJECT RESOLUTION	PROPOSED RESOLUTION STATEMENT	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS PER IDVP (1)	CAUSE CATEGORY (2)
963	FOR THE PURPOSE OF SEISMIC PIPE ANALYSIS, SUPPORT 58S-32R WAS ASSUMED TO BE RIGID, I.E., RESTRAINING PIPE MOVEMENT, IN THE VERTICAL UPWARD DIRECTION AND EAST-WEST DIRECTION. HOWEVER, FIELD INSPECTION SHOWED THE SUPPORT DID NOT RESTRAIN THE PIPE IN THE VERTICAL UPWARD AND EAST-WEST DIRECTION. THE SEISMIC PIPE ANALYSIS IS CURRENTLY BEING REVISED. IT IS NOT KNOWN AT THIS TIME WHETHER MODIFICATION WILL BE REQUIRED.	THE SEISMIC ANALYSIS NO. 8-34, WHICH MODELS SUPPORT 58S-32R AS A VERTICAL AND EAST-WEST RESTRAINT WILL BE RERUN TO DETERMINE IF SUPPORT MODIFICATION IS REQUIRED.		SECTION 2.2.1 2.2.1.3.2.1	B	1
983	RACEWAY SUPPORT REEVALUATION (INCLUDES FILES 910 AND 930).	THE SUPPORTS FOR SAFETY-RELATED ELECTRICAL RACEWAYS ARE BEING REEVALUATED AS PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.4.4	A	2, 3
1002	THIS SEISMIC ANALYSIS OF 3 VENTILATION FANS (SUPPLY FANS S67, S68, AND S69) WAS FOUND TO HAVE USED INCORRECT SPECTRA.	THE VENTILATION FANS WERE REANALYZED USING THE CORRECT SPECTRA.	QUALIFICATION WAS DEMONSTRATED FOR ALL 3 FANS. NO MODIFICATIONS WERE REQUIRED.	NONE	B	2

EOI FILE NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF PROPOSED PROJECT RESOLUTION	PROPOSED RESOLUTION STATEMENT	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS PER IDVP (1)	CAUSE CATEGORY (2)
1013	SPECTRA USED FOR SHAKE TABLE TESTING OF TWO ELECTRICAL COMPONENTS DID NOT COMPLETELY ENVELOPE THE REQUIRED HOSGRI SPECTRA.	IT WAS DETERMINED THAT THE SPECTRA USED FOR TESTING DID ENVELOPE THE REQUIRED HOSGRI SPECTRA AT ALL RESONANT FREQUENCIES OF THE EQUIPMENT.	NO REANALYSIS OR MODIFICATION IS NEEDED.	NONE	B	3
1014	CONTAINMENT SEISMIC REVIEW (INCLUDES FILES 977 AND 1009).	THE CONTAINMENT BUILDING IS BEING REEVALUATED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.1.1	A OR B	1
1022	INTAKE STRUCTURE SEISMIC REVIEW (INCLUDES FILES 967 AND 988).	THE INTAKE STRUCTURE IS BEING REEVALUATED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.1.5	A OR B	1, 2
1026	TURBINE BUILDING SEISMIC REVIEW (INCLUDES FILES 982, 984, 989, 1010, AND 1025).	THE TURBINE BUILDING IS BEING REEVALUATED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.1.4	A OR B	1
1069	THE SEISMIC ANALYSIS OF TWO VALVES WAS MADE CONSIDERING THAT THESE VALVES WERE SUPPORTED. REVIEW OF DRAWINGS AND A FIELD INSPECTION REVEALED THAT THE VALVES WERE NOT SUPPORTED. WITHOUT SUPPORTS ON THESE VALVES, THE PIPING IS OVERSTRESSED. TO RESOLVE THIS ERROR, SUPPORTS ARE BEING PROVIDED FOR THESE VALVES.	REANALYSIS NO. 2-14, REV 6, WAS ISSUED 1/12/82. THIS ANALYSIS REQUIRED SUPPORTS TO BE ADDED TO VALVES LCV 113 AND LCV 115. THE REQUIRED SUPPORTS WILL BE DESIGNED AND INSTALLED.		SECTION 2.2.1 2.2.1.3.2.1	A	1, 3

EOI FILE NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF PROPOSED PROJECT RESOLUTION	PROPOSED RESOLUTION STATEMENT	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS PER IDVP (1)	CAUSE CATEGORY (2)
1092	FUEL HANDLING BUILDING REEVALUATION (INCLUDES FILES 990, 991, 1027, AND 1091).	THE FUEL HANDLING BUILDING IS BEING REANALYZED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.1.3	A	1, 3
1096	ANALYSIS PERFORMED BY THE IDVP ON A VENTILATION FAN RESULTED IN A CALCULATED STRESS ABOVE THE ALLOWABLE VALUE.	THE VENTILATION FAN WILL BE REEVALUATED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. IT IS NOT KNOWN AT THIS TIME WHETHER ANY MODIFICATIONS WILL BE REQUIRED.		SECTION 2.3.3	POTENTIAL A	3
1097	AUXILIARY BUILDING SEISMIC REEVALUATION (INCLUDES FILES 920, 986, 1029, 1070, AND 1093).	THE AUXILIARY BUILDING IS BEING REANALYZED AS A PART OF THE INTERNAL TECHNICAL PROGRAM.		SECTION 2.1.2	A OR B	2
1098	PIPING SEISMIC REEVALUATION (INCLUDES FILES 961, 1021, 1058, 1059, 1060, AND 1104).	THE PIPING SEISMIC REEVALUATION IS BEING PERFORMED AS A PART OF THE INTERNAL TECHNICAL PROGRAM. MODIFICATIONS WILL BE MADE IF REQUIRED.		SECTION 2.2	A OR B	1, 2

Notes For Appendix 1C:

(1) ERROR DEFINITIONS

Class A - An Error is considered Class A if design criteria or operating limits of safety-related equipment are exceeded and physical modifications or changes in operating procedures are required. Any PG&E corrective action is subject to verification by the IDVP.

Class B - An Error is considered Class B if design criteria or operating limits of safety-related equipment are exceeded but can be resolvable by more realistic calculations or retesting. Any PG&E corrective action is subject to verification by the IDVP.

Class C - An Error is considered Class C if incorrect engineering or installation of safety-related equipment is found, but no design criteria or operating limits are exceeded. No physical modifications are required but, if any are applied, they are subject to verification by the IDVP.

Class D - An Error is considered Class D if safety-related equipment is not affected. No physical modifications are required but, if any are applied, they are subject to verification by the IDVP.

Open Item - An open item is an issue that has been reported which requires further investigation in order to recategorize as an error, deviation, or closed item, according to the classification developed by the IDVP.

(2) CAUSE CATEGORY DEFINITIONS

Category 1 - Causes relating to the evolution of technology, criteria, and requirements coupled with control of the iterative engineering process

Category 2 - Causes involving interfaces and communications

(2) CAUSE CATEGORY DEFINITIONS (CONT'D)

Category 3 - Causes of an isolated nature which generally do not fit in either of the above two categories.

APPENDIX 1D

RESOLUTION OF INTERNAL TECHNICAL PROGRAM OPEN ITEMS

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
1	MODELING OF ALL ANNULUS AREA VALVES WAS REVIEWED. SIX VALVES WERE FOUND TO BE MODELED INCORRECTLY.	THE INITIAL CONCERN ADDRESSED INAPPROPRIATE MODELING OF VALVE ECCENTRIC MASSES AT THE PIPE CENTER LINE, AND ALL ANALYSES WERE REVIEWED TO LOCATE MODELING ERRORS OF THIS TYPE. THE MODELS HAVE BEEN CORRECTED AND ANALYSES RERUN. THE INTERNAL TECHNICAL PROGRAM INCLUDES REVIEW AND REANALYSIS, AS NECESSARY, FOR OTHER VALVE MODELING ISSUES SUCH AS EXTENDED STRUCTURE STIFFNESS, VALVE WEIGHTS, AND LOCATION OF THE EXTENDED MASS CENTER OF GRAVITY.		SECTION 2.2.1 2.2.1.3.3.2(2) 2.2.2 2.2.2.3.1.2	A	1, 3
2	THE DIGITIZATION OF THE EAST-WEST TRANSLATIONAL HOSGRI SPECTRA FOR THE 140' ELEVATION IN THE AUXILIARY BUILDING HAS BEEN FOUND TO CONTAIN AN ERROR.	ALL PIPING ANALYSES WERE REVIEWED TO IDENTIFY AFFECTED PIPING. ONE ANALYSIS WAS FOUND TO NEED REANALYSIS. THIS PIPING ANALYSIS WAS RERUN.	REANALYSES IS COMPLETE, AND SUPPORT REDESIGN AND QUALIFICATION ARE COMPLETE.	SECTION 2.1.2	A	3
3	THE METHOD USED TO CALCULATE RACEWAY WEIGHTS RESULTED IN AN UNDERESTIMATION OF THE WEIGHTS OF SOME CONDUITS.	A REVIEW OF ALL SAFETY-CLASS RACEWAY SUPPORTS IS BEING CONDUCTED. THE SUPPORTS EITHER WILL BE QUALIFIED BY ANALYSIS OR WILL BE MODIFIED.		SECTION 2.4	A OR B	2, 3

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
4	REVIEW OF ALL UNIT 1 SMALL BORE PIPING HAS IDENTIFIED FORTY SUPPORTS REQUIRING VERTICAL RESTRAINT WHERE ONLY A SINGLE ROD WAS UTILIZED.	ALL SMALL BORE PIPING SINGLE ROD SUPPORTS REQUIRED TO FUNCTION AS VERTICAL RES-TRAINTS WILL BE IDENTIFIED AND MODIFIED TO PROVIDE RESTRAINT TO BOTH UPWARD AND DOWNWARD MOVEMENT.	FORTY SINGLE ROD SUPPORTS WERE FOUND IN LOCATIONS WHICH REQUIRED VERTICAL RESTRAINT AND THESE SUPPORTS HAVE BEEN MODIFIED TO PREVENT UPLIFT.	SECTION 2.2.4.1.1	A	1
5	ONE VALVE LIST IN THE HOSGRI REPORT WAS NOT UPDATED AS REQUIRED BY THE SECOND PHASE.	A COMPLETE LISTING OF ALL ACTIVE VALVES REQUIRED FOR COLD SHUTDOWN FOLLOWING A SEISMIC EVENT WILL BE PREPARED AND THESE VALVES WILL BE REVIEWED TO ASSURE THEY ARE QUALIFIED TO HOSGRI CRITERIA.		SECTION 2.2.1 2.2.1.3.4(3) 2.2.2.3.2.2	A OR B	2, 3

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
6	CERTAIN SMALL BORE PIPING SPANS HAVE BEEN IDENTIFIED AS DEVIATING FROM SEISMIC CRITERIA.	A LARGE SAMPLE OF SMALL BORE PIPING HAS BEEN REVIEWED AND OVERSPANS IDENTIFIED. ANALYSIS HAS BEEN COMPLETED TO IDENTIFY THOSE SPANS WHICH MAY INCUR SEISMIC STRESSES EXCEEDING ALLOWABLES. THE PERCENTAGE OF SPANS IN THIS CLASS RELATIVE TO THE TOTAL POPULATION IS 0.19%. DESIGN REQUIREMENTS HAVE BEEN ISSUED TO CORRECT THE FEW OVERSTRESSES FOUND. VERIFICATION OF SUPPORT QUALIFICATIONS ASSOCIATED WITH OVERSPANS IS COMPLETE, AND ALL SUPPORTS REVIEWED WERE FOUND TO COMPLY WITH THE ORIGINAL ACCEPTANCE CRITERIA. A SAMPLE REVIEW TO ADDRESS THE CUMULATIVE EFFECT OF OVERSPANS COUPLED WITH OTHER ISSUES IS IN PROGRESS.		SECTION 2.2.2, 2.2.2.3.3, 2.2.4, 2.2. 2.2.4.3.2.2	A	1
7	PIPING REVIEW OF THE ANNULUS REVEALED TWO THERMAL ANALYSES WHICH USED INCORRECT MODELING OF SUPPORTS.	THE TWO THERMAL ANALYSES WILL BE RERUN AND SUPPORTS QUALIFIED. ALSO, ALL THERMAL ANALYSES WILL BE REVIEWED AND THOSE FOUND TO CONTAIN SUPPORT MODELING ERRORS WILL BE RERUN AND ASSOCIATED SUPPORTS WILL BE REQUALIFIED.	THE TWO THERMAL ANALYSES HAVE BEEN RERUN AND SUPPORTS QUALIFIED.	SECTION 2.2.1, 2.2.1.3.2.1, 2.2.2, 2.2.2.3.2.1 2.2.2.3.3	A OR B	1, 3

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
8	PIPING WITH SUPPORTS ATTACHED TO THE CONTAINMENT INTERNAL STRUCTURE ABOVE ELEVATION 140' WERE DYNAMICALLY ANALYZED USING 140' SPECTRA. PIPING, ELECTRICAL RACEWAY, AND SUPPORTS ATTACHED TO THE CONTAINMENT EXTERIOR PIPEWAY WERE ANALYZED USING CONTAINMENT EXTERIOR SPECTRA.	APPROPRIATE SPECTRA WERE DEVELOPED. THE NEW SPECTRA ARE BEING COMPARED TO SPECTRA USED IN THE PREVIOUS QUALIFICATIONS. WHERE QUALIFYING SPECTRA DO NOT ENVELOPE THE NEW SPECTRA, ANALYSES WILL BE PERFORMED TO QUALIFY PIPING SYSTEMS AND ELECTRICAL RACEWAY TO CRITERIA. MODIFICATIONS WILL BE PERFORMED, AS REQUIRED.	THE APPROPRIATE SPECTRA HAVE BEEN DEVELOPED.	SECTION 2.2.1, 2.2.1.3.2.2, 2.2.2, 2.2.2.3.2.1, 2.2.2.3.3	A OR B	1
9	ONE CASE OF A PIPE SUPPORT DESIGN WITH FEWER PIPE LUGS THAN REQUIRED BY DESIGN CRITERIA, RESULTING IN LOCAL PIPE OVERSTRESS, HAS BEEN IDENTIFIED.	ALL WELDED PIPE ATTACHMENT DESIGNS WILL BE REVIEWED AND QUALIFIED OR REDESIGNED. INCLUDED IN THIS REVIEW ARE LOCAL PIPE STRESS EFFECTS.		SECTION 2.2.3, 2.2.3.3.1, 2.2.4 2.2.4.3.1.4	A	1, 3
10	SEVEN PIPING ANALYSES WERE IDENTIFIED FOR WHICH THE SPECTRA SETS USED WERE NOT ENVELOPED BY THE APPROPRIATE REVISED REORIENTED SPECTRA.	THE SEVEN ANALYSES WILL BE RERUN USING APPROPRIATE SPECTRA SETS AND ALL REMAINING PIPING ANALYSES WILL BE REVIEWED TO ASSURE USE OF ALL APPROPRIATE SPECTRA. WHERE REQUIRED, ANALYSES WILL BE RERUN. MODIFICATION WILL BE PERFORMED AS REQUIRED.	THE SEVEN PIPING ANALYSES HAVE BEEN RERUN.	SECTION 2.2.1 2.2.1.3.2.2 2.2.2 2.2.2.3.2.1 2.2.2.3.3	A	2

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
11	DYNAMIC PROPERTIES USED IN THE SEISMIC QUALIFICATION OF THE PLANT EXHAUST VENT WILL BE REVIEWED.	THE PLANT VENT DESIGN WAS REVIEWED. AN APPROPRIATE MODEL WAS DEVELOPED. A DYNAMIC ANALYSIS WAS PERFORMED.	A DYNAMIC ANALYSIS OF THE PLANT VENT HAS BEEN COMPLETED. THE VENT AND ITS SUPPORTS HAVE BEEN DETERMINED TO MEET CRITERIA.	NONE	B	2, 3
12	SOME MASSES WERE REPRESENTED INCORRECTLY IN THE FORMULATION OF THE VERTICAL DYNAMIC MODEL OF THE CONTAINMENT INTERIOR STRUCTURE.	A DESIGN REVIEW OF THE VERTICAL DYNAMIC MODEL HAS BEEN MADE TO DETERMINE THE SIGNIFICANCE FOR THE CONTAINMENT INTERIOR STRUCTURE. REVISED FLOOR RESPONSE SPECTRA HAVE BEEN GENERATED FOR THREE FRAMES: FRAME 2 AND 3 AT ELEVATION 101, AND FRAME 5 AT ELEVATION 140 OF THE MODEL. PIPING AND EQUIPMENT WILL BE REVIEWED FOR THE EFFECT OF THESE SPECTRA CHANGES AND, WHERE REQUIRED, REANALYSIS WILL BE PERFORMED.	PIPING ANALYSES WERE FOUND TO BE UNAFFECTED BY THE SPECTRA CHANGES; QUALIFYING SPECTRA ARE FOUND TO ENVELOPE THE NEW SPECTRA. THIS ITEM IS CLOSED FOR PIPING (820604). EQUIPMENT REVIEW IS CONTINUING.	SECTION 2.1.1	B	2, 3
13	RLCA HAS IDENTIFIED NUMEREOUS DISCREPANCIES BETWEEN THE AS-BUILT PIPING CONFIGURATIONS AND THE PIPING ISOMETRIC DRAWINGS.	AUDITS, DRAWING REVISIONS AND, AS NECESSARY, PLANT MODIFICATIONS WILL BE PERFORMED. FIELD AS-BUILT CHECKS WILL BE CONDUCTED TO VERIFY DESIGN INFORMATION.		SECTION 2.2.1 2.2.1.3.2.1 2.2.2 2.2.2.3.2.1 2.2.2.3.3	A	1

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
14	A DEFICIENCY IN THE SMALL BORE SEISMIC ANCHOR MOVEMENT DESIGN CRITERIA DOCUMENT WAS FOUND DURING REVIEW AND REQUALIFICATION OF SMALL BORE PIPING FOR ATTACHED LARGE BORE PIPING REVISED DISPLACEMENTS. THE INSTRUCTION FOR PROJECTION OF SKEWED LINES INTO EFFECTIVE LENGTHS FOR THE APPROPRIATE PLANES RESULTED IN GREATER SPAN LENGTHS THAN THE TRUE PROJECTED LENGTH.	THE INSTRUCTION WAS CORRECTED. SMALL BORE PIPING WAS REVIEWED AND REANALYZED USING CORRECT PROJECTED SPAN LENGTHS.	SMALL BORE PIPING ATTACHED TO DYNAMICALLY ANALYZED LARGE BORE PIPING HAS BEEN REVIEWED AND ANALYZED. NO MODIFICATIONS WERE FOUND TO BE REQUIRED.	SECTION 2.2.2	C	
15	DOCUMENTATION OF THE QUALIFICATIONS OF CERTAIN SMALL BORE PIPING SUPPORT STANDARD DETAILS FOR BIDIRECTIONAL LOADING CANNOT BE LOCATED.	THE STANDARD SUPPORT DETAILS WILL BE QUALIFIED AND MODIFICATIONS PERFORMED, IF REQUIRED. THE EFFECTS OF SPECTRA REVISIONS AND INSULATION WEIGHT WILL BE INCLUDED IN THE REVIEW.		SECTION 2.2.4 2.2.4.3.1.1	A OR B	3
16	THE EXISTING FILE 44 HOSGRI HORIZONTAL SEISMIC COEFFICIENT FOR THE AUXILIARY BUILDING AT ELEVATION 163' IS 5. IT SHOULD BE 8.5.	THE FILE 44 HORIZONTAL AND VERTICAL SEISMIC COEFFICIENTS ARE BEING VERIFIED FOR CONSISTENCY WITH CURRENT SPECTRA. CHANGES WILL BE REVIEWED FOR EFFECT ON DESIGN AND MODIFICATIONS PERFORMED, IF REQUIRED.		SECTION 2.2.4 2.2.4.3.1.1 2.2.4.3.2.2	A OR B	3

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
17	SEISMIC ANCHOR MOVEMENT (SAM) EFFECTS WERE NOT ADDRESSED IN PIPING ANALYSES FOR LARGE BORE PG&E DESIGN CLASS I LINES THAT WERE INSTALLED BY SPAN CRITERIA AND ATTACHED TO COMPUTER ANALYZED LINES.	ALL LARGE BORE PIPING WILL BE ANALYZED BY COMPUTER AND THE EFFECT OF SAM WILL BE CONSIDERED.		SECTION 2.2.1 2.2.1.3.1.1	A OR B	1
18	CLASS I EQUIPMENT FOR THE AUXILIARY SALTWATER SYSTEM IN THE INTAKE STRUCTURE WERE QUALIFIED TO THE HOSGRI GROUND RESPONSE SPECTRA INSTEAD OF THE FLOOR RESPONSE SPECTRA.	SEISMIC ANALYSES FOR CLASS I EQUIPMENT AND PIPING FOR THE AUXILIARY SALTWATER SYSTEM ARE BEING REVIEWED TO ASSURE THAT THE EQUIPMENT SEISMIC QUALIFICATION IS MAINTAINED.		SECTION 2.2.1 2.2.1.3.2.2 2.3 2.4 2.5	A OR B	1
19	THE NRC CONSIDERS THAT THE 3D ANALYSIS OF THE CONTAINMENT POLAR CRANE SHOWS THAT THE RESULTS OF THE 2D NONLINEAR ANALYSIS INCLUDED IN THE HOSGRI REPORT ARE UNCONSERVATIVE.	THE POLAR CRANE IS BEING REANALYZED TO ASSURE THAT DESIGN COMPLIES WITH SEISMIC CRITERIA. THE 3D ANALYSIS BEING PERFORMED HAS IDENTIFIED SOME AREAS THAT MAY REQUIRE STRENGTHENING.		SECTION TO BE ADDED LATER	A OR B	1
20	THE SEISMIC ANALYSIS OF THE CONTAINMENT DOME SERVICE CRANE UTILIZED SOME RESULTS OF THE 3D NONLINEAR POLAR CRANE ANALYSIS. THESE ANALYSES HAVE NOT YET BEEN SUBMITTED FOR NRC REVIEW.	THE DOME SERVICE CRANE WILL BE REANALYZED. SINCE INPUT FROM THE POLAR CRANE IS NEEDED FOR THESE ANALYSES, THESE ANALYSES WILL BE COMPLETED WHEN THE POLAR CRANE ANALYSIS IS COMPLETE.		SECTION TO BE ADDED LATER	A OR B	1

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
21	CALCULATIONS MADE BY EDS FOR 14" HVAC DUCT SUPPORT LOADINGS USED INCORRECT SEISMIC RESPONSE SPECTRA IN SOME CASES. THIS MAY HAVE RESULTED BECAUSE THE SPECTRA PROVIDED BY PG&E (SHOWN IN APPENDIX A OF THE EDS CALCULATION FILE) INADVERTENTLY OMITTED DESIGNATING THE ELEVATION 163' SPECTRA AS PERTAINING TO THE AUXILIARY BUILDING ONLY. APPARENTLY, EDS PERSONNEL ASSUMED THAT THOSE SPECTRA COULD BE USED FOR SEISMIC LOADING AT ELEVATION 163' IN THE TURBINE BUILDING.	FLOOR RESPONSE SPECTRA AT ELEVATION 163' IN THE TURBINE BUILDING HAVE BEEN DEVELOPED BY PG&E . THE HVAC DUCT AND ITS SUPPORTS HAVE BEEN REANALYZED FOR THESE APPROPRIATE SPECTRA. THE TURBINE BUILDING HAS BEEN CHECKED FOR THE NEW SUPPORT LOADS RESULTING FROM THE REANALYZED HVAC DUCT SUPPORTS.	RESULTS OF THE REANALYSIS THUS FAR INDICATE THAT QUALIFICATIONS OF THE HVAC DUCT WILL BE MAINTAINED, AND NO MODIFICATIONS ARE NECESSARY.	SECTION 2.5.3	A OR B	2
22	THE REACTOR COOLANT SYSTEM PRESSURIZER SUPPORTS AND THE COMPONENT COOLING WATER HEAT EXCHANGER WERE MODELED IN COMPANY SCOPE PIPING ANALYSES AS RIGID.	REVIEW OF THE PRESSURIZER SUPPORT DETERMINED THE STIFFNESS TO BE 2.04×10^8 LB/IN, WHICH IS CONSISTENT WITH THE DIABLO CANYON CRITERIA FOR MODELING AS RIGID. THE ANALYSIS OF PIPING WITH THE ACTUAL COMPONENT COOLING WATER HEAT EXCHANGER STIFFNESS RESULTED IN SUPPORT LOAD INCREASES BUT ACCEPTABLE PIPE STRESS. ACTIONS ARE IN PROGRESS TO IDENTIFY ALL EQUIPMENT THAT DOES NOT QUALIFY FOR RIGID MODELING AND REANALYSIS WILL BE PERFORMED.		SECTION 2.2.1 2.2.1.3.3.2(4) 2.2.2 2.2.2.3.2.1	A	1

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
23	THE BLUME INTERNAL REVIEW HAS DETERMINED THAT SEVERAL COMPUTER ANALYSES WERE PERFORMED BEFORE IT WAS REQUIRED THAT ALL COMPUTER ANALYSES BE PERFORMED WITH QA VERIFIED COMPUTER CODES.	THE PROGRAMS ARE BEING VERIFIED. REANALYSES WILL BE PERFORMED, IF REQUIRED.		SECTION TO BE ADDED LATER	A OR B	1
24	THE BLUME INTERNAL REVIEW HAS IDENTIFIED SEVERAL QUESTIONS CONCERNING THE TURBINE BUILDING ANALYSIS. THESE QUESTIONS ARE RELATED TO THE MATHEMATICAL MODELING AND ANALYSIS OF THE BUILDING AND TO THE EFFECT OF SOME OF THE HOSGRI MODIFICATIONS ON THE BUILDING RESPONSE.	URS/BLUME IS REVIEWING EACH AREA OF CONCERN TO DETERMINE ITS RESOLUTION. PG&E IS CONTINUING TO MONITOR THERE SOLUTION OF THE BIR ISSUES. IN ADDITION, PG&E IS PERFORMING PARAMETRIC STUDIES IN ITS EFFORT TO MONITOR ANY REANALYSIS AND MODICATIONS CONSIDERED NECESSARY TO ASSURE THAT QUALIFICATION IS MAINTAINED.		SECTION 2.1.4	OPEN ITEM	
25	THE BLUME INTERNAL REVIEW HAS IDENTIFIED QUESTIONS RELATED TO THE SEISMIC ANALYSIS OF THE CONTAINMENT INTERIOR. THESE QUESTIONS ARE INSUFFICIENTLY ADDRESSED IN THE EXISTING DOCUMENTATION OF THE ANALYSES, AND RELATE TO THE MASS, SHEAR VALUES, STIFFNESS, AND TO THE CENTERS OF MASS AND RIGIDITY OF THE MODEL, AS WELL AS TO THE INTERPRETATION OF SOME OF THE RESULTS.	URS/BLUME IS REVIEWING EACH AREA OF CONCERN TO DETERMINE ITS RESOLUTION. PG&E IS CONTINUING TO MONITOR THE RESOLUTION OF THE BIR. IN ADDITION, PG&E IS PERFORMING PARAMETRIC STUDIES IN ITS EFFORT TO MONITOR ANY REANALYSIS AND MODIFICATIONS CONSIDERED NECESSARY TO ASSURE THAT QUALIFICATION IS MAINTAINED.		SECTION 2.1.1	OPEN ITEM	

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
26	THE BLUME INTERNAL REVIEW HAS REQUESTED URS/BLUME TO REVISE THE AUXILIARY BUILDING REPORT TO REFLECT THE ACTUAL TIME HISTORY USED IN THE ANALYSIS (20 RATHER THAN 24 SECONDS LONG) AND TO SUPPLEMENT THE CALCULATIONS TO DEMONSTRATE THE APPROPRIATENESS OF THE TRUNCATED TIME-HISTORY.	THE AUXILIARY BUILDING REPORT, "DIABLO CANYON NUCLEAR POWER PLANT, AUXILIARY BUILDING DYNAMIC SEISMIC ANALYSIS FOR THE 7.5M HOSGRI EATHQUAKE," HAS TO BE REVISED TO REFLECT THE ACTUAL TIME-HISTORY USED IN THE ANALYSIS PERFORMED BY URS/BLUME (20 RATHER THAN 24 SECONDS LONG). CALCULATIONS TO DETERMINE THE APPROPRIATENESS OF THE TRUNCATED TIME-HISTORY WERE PERFORMED. THE ANALYSIS WAS RERUN USING THE 24-SECOND TIME-HISTORY. THE RESULTS BETWEEN THE 24- AND THE 20-SECOND TIME-HISTORIES WERE COMPARED AND WERE FOUND TO BE IDENTICAL.	THE REPORT HAS BEEN REVISED TO REFLECT THE ACTUAL TIME-HISTORY USED. CALCULATIONS HAVE BEEN INCLUDED IN REVISION 1 OF THE CALCULATION FILES WHICH DEMONSTRATE THAT THE TRUNCATED TIME-HISTORY PRODUCES AN IDENTICAL RESPONSE SPECTRUM TO THAT OF THE ORIGINAL TIME-HISTORY.	SECTION 2.1.2	C	
27	THE BLUME INTERNAL REVIEW HAS IDENTIFIED A POSSIBLE DISCREPANCY IN THE CORRELATION BETWEEN INTAKE STRUCTURE INPUT SPECTRUM AND FLOOR RESPONSE SPECTRA. THIS MAY AFFECT THE INTAKE STRUCTURE CRANE ANALYSIS. IT WAS ALSO NOTED THAT THE INTAKE STRUCTURE SEISMIC ANALYSIS DID NOT INCLUDE THE EFFECTS OF A TSUNAMI AFTER POSSIBLE SEISMIC DAMAGE TO THE INTAKE FLOW DIVIDER WALLS.	URS/BLUME HAS DEVELOPED FLOOR RESPONSE SPECTRA FOR THE INTAKE STRUCTURE AND HAS PERFORMED ANALYSES OF THE INTAKE STRUCTURE CRANE WITH THAT SPECTRA. THE EFFECTS OF A TSUNAMI ON THE INTAKE STRUCTURE ARE BEING REVIEWED TO DETERMINE WHETHER MODIFICATIONS ARE NEEDED. IF NECESSARY, MODIFICATIONS WILL BE PERFORMED.	THE INTAKE CRANE STRUCTURE HAS BEEN QUALIFIED WITH THE CORRECT FLOOR RESPONSE SPECTRA, AND NO MODIFICATIONS ARE NECESSARY.	SECTION 2.1.5	OPEN ITEM	

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
28	AN ELECTRICAL DESIGN REVIEW HAS FOUND THAT INCORRECT CIRCUIT BREAKERS WERE SUPPLIED FOR CERTAIN 125 VDC CIRCUITS; 20,000 AMP INTERRUPTING CAPACITY BREAKERS WERE SPECIFIED; HOWEVER, 10,000 AMP BREAKERS WERE RECEIVED AND INSTALLED.	20,000 AMP INTERRUPTING CAPACITY BREAKERS WERE PROCURED AND WILL BE INSTALLED.	SIX REPLACEMENT BREAKERS WILL BE INSTALLED THAT MEET SPECIFICATIONS.	NONE	A	3
29	PIPE SUPPORT SPACING TABLES FOR NONCOMPUTER ANALYZED PIPING DO NOT CONSIDER THE EFFECT OF THE PIPE INSULATION, AND THE TABLE USED FOR PIPING GREATER THAN 4" DIAMETER WAS NOT REVIEWED, APPROVED, AND CONTROLLED AS REQUIRED BY THE PG&E QUALITY ASSURANCE PROGRAM.	NEW SPACING TABLES WHICH CONSIDER THE WEIGHT OF INSULATION ARE PREPARED AND THE EFFECT ON PIPING AND SUPPORT DESIGN WILL BE DETERMINED. LARGE BORE PIPING WILL BE REANALYZED BY COMPUTER. MODIFICATIONS, IF REQUIRED, WILL BE MADE.		SECTION 2.2.1 2.2.2 2.2.2.3.3 2.2.4.3.2.2	A OR B	1
30	DURING THE ADDITION IN 1979 OF THE CONTROL ROOM PRESSURIZATION SYSTEM, THE VITAL ELECTRICAL POWER SUPPLY TO THE REDUNDANT CONTROL ROOM HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEM FOR EACH UNIT WAS CHANGED. THIS CHANGE DEFEATED THE ABILITY OF THE UNIT 1 CONTROL ROOM HVAC SYSTEM TO MEET THE SINGLE FAILURE CRITERIA IF UNIT 2 WERE NOT OPERATING.	TWO TESTS HAVE BEEN PERFORMED. THESE TESTS PROVIDED PERFORMANCE DATA THAT PRESSURIZATION, AIR DISTRIBUTION, AND TEMPERATURE CONTROL CAN BE MAINTAINED SATISFACTORILY WITH ONE OF FOUR VENTILATION TRAINS. ELECTRICAL POWER MODIFICATIONS SHALL BE MADE TO BE COMPATIBLE BY PROVIDING REDUNDANT AIR CONDITIONING, VENTILATION, AND PRESSURIZATION TO THE UNIT 1 AND UNIT 2 CONTROL ROOM; AND COMPLYING WITH SINGLE FAILURE CRITERIA.		NONE	OPEN ITEM	

OPEN ITEM NO.	DESCRIPTION OF CONCERN	DESCRIPTION OF RESOLUTION	CONCLUSIVE STATEMENT OF RESOLUTION	REFERENCE TO ITP PHASE I FINAL REPORT	ERROR CLASS[1] PER IDVP	CAUSE CATEGORY[2]
31	THE BLUME INTERNAL REVIEW HAS IDENTIFIED CERTAIN ITEMS WHICH REQUIRE FURTHER INVESTIGATION TO CHECK THE ACCEPTABILITY OF WELDED PIPE ATTACHMENTS AT THE MAIN STEAM AND FEEDWATER PIPING ANCHOR. THE ANCHOR IS LOCATED ON COLUMN LINE G.	REANALYSIS OF THE MAIN STEAM AND FEEDWATER PIPING ANCHOR PIPE ATTACHMENTS AND WELDS WILL BE PERFORMED. THE PIPE ATTACHMENTS AND WELDS DESIGNS WILL BE REVIEWED TO DETERMINE COMPLIANCE TO SEISMIC CRITERIA. MODIFICATIONS WILL BE PERFORMED, IF NECESSARY.		SECTION 2.2.3 2.2.3.3.1	A OR B	1
32	MODELS AND ASSUMPTIONS USED IN THE ANALYSES FOR THE SEISMIC QUALIFICATION OF THE FUEL HANDLING BUILDING STEEL SUPERSTRUCTURE MAY HAVE RESULTED IN DESIGNS WHICH DO NOT TOTALLY SATISFY ALL OF THE APPLICABLE CRITERIA.	A STUDY IS BEING PERFORMED TO DETERMINE WHAT MODIFICATIONS ARE NEEDED. REANALYSIS OF THE STRUCTURE IS BEING PERFORMED BY USING A FINITE-ELEMENT MODEL. EVALUATION IS UNDER WAY TO CHECK THE ACCEPTABILITY OF THE MEMBERS AND THEIR CONNECTIONS TO SEISMIC CRITERIA.		SECTION 2.1.3	A	1, 3
33	A REVIEW OF THE HOSGRI QUALIFICATION CALCULATIONS FOR CLASS I HVAC DUCT SUPPORTS IDENTIFIED A GENERIC SUPPORT TYPE WHICH APPARENTLY DOES NOT SATISFY THE APPLICABLE CRITERIA.	A REVIEW OF TWENTY GENERIC, CLASS I HVAC DUCT SUPPORT DESIGNS IS UNDER WAY TO DETERMINE THE SEISMIC ADEQUACY OF ALL CLASS I HVAC DUCT SUPPORTS. MODIFICATIONS WILL BE PERFORMED WHERE NECESSARY.		SECTION 2.5.4	A OR B	1, 3

Notes For Appendix 1D:

(1) ERROR DEFINITIONS

Class A - An Error is considered Class A if design criteria or operating limits of safety-related equipment are exceeded and physical modifications or changes in operating procedures are required. Any PG&E corrective action is subject to verification by the IDVP.

Class B - An Error is considered Class B if design criteria or operating limits of safety-related equipment are exceeded but can be resolvable by more realistic calculations or retesting. Any PG&E corrective action is subject to verification by the IDVP.

Class C - An Error is considered Class C if incorrect engineering or installation of safety-related equipment is found, but no design criteria or operating limits are exceeded. No physical modifications are required but, if any are applied, they are subject to verification by the IDVP.

Class D - An Error is considered Class D if safety-related equipment is not affected. No physical modifications are required but, if any are applied, they are subject to verification by the IDVP.

Open Item - An open item is an issue that has been reported which requires further investigation in order to recategorize as an error, deviation, or closed item, according to the classification developed by the IDVP.

(2) CAUSE CATEGORY DEFINITIONS

Category 1 - Causes relating to the evolution of technology, criteria, and requirements coupled with control of the iterative engineering process

Category 2 - Causes involving interfaces and communications

(2) CAUSE CATEGORY DEFINITIONS (CONT'D)

Category 3 - Causes of an isolated nature which generally do not fit in either of the above two categories.

APPENDIX 1E

Appendix 1E

Table E1

Identified Modifications

Resulting From the Independent Design Verification Program or the Internal Technical Program[1]

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
1	Valve FCV-95	Aux. bldg elev 100 Area GE	Yoke stiffeners made of 3/8" plate, should be 1/2".	Removed 3/8" plates and replaced them with 1/2" as per design.	EOI-950
2	One containment fan cooler (No. 1-3)	Containment annulus, elev. 140'	One support weld was found to exceed AISC code by about 14% (as a result of the revised vertical spectra in the annulus area of the containment).	Improved weld as follows: o Added 3/8" fillet weld on a third side of the support foot plate o Increased the size of the existing fillet welds from 5/8" to 3/4". This modification involved only one of the 19 supports on fan cooler No. 1-3. The modification was due to small installation variations of welds between a column foot and its corresponding embedded plate not being identical for all five fan coolers.	None

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
3	PT 932 Instrument tubing supports	Annulus, elev. 101 at 103°	Torsional stress at member A1200 has exceeded the allowable stress. Torsional Stress = 32.5 Ksi | 19 Ksi allowable stress	Lateral bracing added to this support. This support did not affect tubing associated with safety related instrumentation. They have been modified for consistency reasons only.	None
4	FE 980/FE926 Instrument tubing supports	Annulus, elev. 101 at 185°	Improper angle bracket used.	Replaced Unistrut angle brace No. AB201 by Unistrut angle brace No. AB213. This support did not affect tubing associated with safety-related instrumentation. They have been modified for consistency reasons only.	None

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
5	Annulus structural steel	Containment bldg	A reanalysis of the annulus structure was required because of the revisions to the HOSGRI vertical model and corresponding changes to the response spectra. The result was an increase in HOSGRI loads, causing overstress in 27 out of 810 wide flange connections and in 11 out of 405 members. Of the 27 connections, the overstress was less than 20% in 7, between 20% and 50% in 11, between 50% and 100% in 3 and between 100% and 480% in 6. Of the 11 members, the overstress was less than 20% in 7, 69% in 1 and between 100% and 220% in 3.	Connections and members are strengthened by addition of plates.	EOI-977

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
5 (continued)			There is sufficient ductility in all the members and connections to accommodate these psuedo-elastic stresses and they could have performed their intended function without modification.		

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
6	Annuciator cabinets	Auxiliary building main control room	Longitudinal stiffeners which brace the cabinets were determined, by R. L. Cloud & Associates, to be less stiff than assumed for analysis.	Structural modifications include installation of additional bracing.	EOI-949
7	Raceway supports Type 102	Auxiliary and turbine bldg.	Supports did not meet acceptance criteria on allowable stress as established by PG&E in design criteria. They can be shown to have sufficient capability, through inelastic analysis, to perform their function and pose no threat to safety. However, it is very time consuming to demonstrate this by analysis; therefore, modifications were carried out.	Sixteen supports have been revised by the addition of one brace (S-6)	OI-3

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
9	Raceway supports Type: S-226 S-315 S-318 S-325	Annulus below elev 140'	Supports did not meet acceptance criteria on allowable stress as established by PG&E in design criteria. They can be shown to have sufficient capability, through inelastic analysis, to perform their function and pose no threat to safety. However, it is very time consuming to demonstrate this by analysis; therefore, modifications were carried out.	Two S-6 braces were added to each of the 22 supports.	OI-3

Appendix 1E

Table E1 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI or Open Item
10	125-Volt dc switchgear	Inverter room, Area H, elev. 115'	Six 125 V dc breakers feeding instrument inverters were specified with the correct interrupting rating of 20,000a. However, 10,000a rated breakers were supplied and installed in the switchgear. The breaker could, under unusual circumstances, fail and disable one of the three redundant 125 V dc buses.	Replace original breakers with properly rated breakers (DC1-E-E-1345).	OI-28
11	Pipe hangers	Various	See summary Table 4		

Appendix 1E
Notes for Table E1

Note 1: The modifications listed in this table are those which have been identified by the Project as of 9/13/82. As additional modifications are identified, this list will be updated.

Appendix 1E

Table E2

Pipe Support Modifications Resulting From

The Independent Design Verification Program

Or The Internal Technical Program[2]

Item No.	Component Modified	Location	Reason	Description of Modification	EOI, IVDP[1] or Open Item No.
1[3]	Pipe support structural modification	Containment and auxiliary bldgs	Cause of these modifications is attributed to one or more of the following: a) Piping analyses did not use as-built piping configuration b) Spectra changes c) Incorrect choice of spectra d) Inadequate valve model or incorrect valve weight e) Natural frequency of the support in restrained or unrestrained direction less than 20 Hz f) Code boundary support upgrade to Design Class I requirements.	86 large bore and 35 small bore support modifications are identified to this category. The modifications consist of one or more of the following types: a) Increased weld size b) Added member or increased member size c) Changed variable spring or snubber size.	EOI-1069, 932 OI-1, 2, 9, 10, 13 IDVP-3.2.4, 3.4.4, 3.9.4

Appendix 1E

Table E2 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI, IDVP[1] or Open Item No.
2[3]	Pipe support base plate and/or anchor bolts modification	Containment and auxiliary bldgs	Cause of these modifications is attributed to one or more of the following: a) Piping analyses did not use as-built piping configuration b) Spectra changes c) Incorrect choice of spectra d) Inadequate valve model or incorrect valve weight.	18 large bore pipe support modifications are identified to this category. The modifications consist of one or more of the following types: a) Added or replaced anchor bolts b) Stiffened existing base plates.	EOI-1069 OI-1, 2, 9, 10, 13 IDVP 3.2.4, 3.4.4, 3.9.4

Appendix 1E

Table E2 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI, IDVP[1] or Open Item No.
3[3]	Pipe support addition	Containment and auxiliary bldgs	Cause of these modifications is attributed to one or more of the following: a) Piping analyses did not use as-built piping configuration b) Spectra change c) Incorrect choice of spectra d) Inadequate valve model or incorrect valve weight e) Seismic pipe span criteria.	10 large bore and 17 small bore supports were added. The modifications consist of adding either a rigid or snubber pipe support.	EOI-1069 OI-1, 2, 6, 10, 13 IDVP-3.2.4, 3.4.4, 3.9.4

Appendix 1E

Table E2 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI, IDVP[1] or Open Item No.
4[3]	Pipe support variable spring or seismic limiter setting adjustment	Containment and auxiliary bldgs	Cause of these modifications is attributed to one of the following: a) Piping analyses did not use as-built piping configuration b) Piping analyses did not consider all fluid conditions.	Three large bore supports were modified to provide increased free movement or to adjust the supporting force.	OI-13 IDVP-3.2.4

Appendix 1E

Table E2 (Cont'd)

Item No.	Component Modified	Location	Reason	Description of Modification	EOI, IDVP[1] or Open Item No.
5[3]	Pipe support gap adjustment	Containment and auxiliary bldgs	Cause of these modifications is attributed to one or more of the following: a) Piping analyses did not use as-built piping configuration b) Spectra changes c) Incorrect choice of spectra d) Excessive gap in a restrained direction.	Forty large bore and 6 small bore support modifications are identified to this category. The modifications consist of adjusting gaps to meet criteria.	EOI-963 OI- 2, 10, 13 IDVP-3.2.4, 3.9.4
6[3]	Rod supports	Containment and auxiliary bldgs	PG&E internal criteria requires all vertical seismic restraints to provide physical restraint in both the upward and downward directions regardless of relationship between dead load and seismic load.	There were no large bore supports identified to this category; 42 small bore supports were identified to this item. The modifications consisted of replacing the rod hangers with a sway strut or a rigid frame.	OI-4

Appendix 1E

Notes for Table E2

1 Where numbers are shown with IDVP notation, this reflects the number of IDVP First Interim Technical Report paragraph which recommended additional review for a cause associated with this category of modification.

2 The modifications listed in this table are those which have been identified by the Project as of 9/13/82.

3 In addition, the following lists specific hangers by modification type and identifies the calculated, allowable, and maximum stress, load, movement or other acceptance criteria. These hangers are judged to be typical of each modification category.

Item	Modification Catagory	Calculated Stress/ Load/Movement/Other	Allowable Stress/ Load/Movement/Other	Max. Capacity
1	Structural support 13/23SL (weld)	32,450 psi	20,700 psi	60,000 psi
	Support 12/46SL (member)	36,894 psi	20,700 psi	60,000 psi
	Support 42/12R (natural frequency)	18 Hz	20 Hz	N/A
2	Base plate/anchor bolts support 11/34SL (anchor bolts)	2097 LBS.	1800 LBS.	7200 LBS.
3	Added support. pipe support 22/335SL (stress)	46,700 psi	36,000 psi	60,000 psi
4	Spring/snubber setting support 12-6 SL	2.5"	2.375"	N/A
5	Support/pipe gaps support 57N/27R	7/32"	1/8"	N/A
6	Rod supports support 2155-66	+/- 40LBS.	-54.3 LBS.	N/A