



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION V

1450 MARIA LANE, SUITE 210  
WALNUT CREEK, CALIFORNIA 94596

September 17, 1982

MEMORANDUM TO: D. G. Elsenhut, Director, Division of Licensing  
FROM: R. H. Engelken, Regional Administrator  
SUBJECT: DIABLO CANYON ACTION ITEMS

In accordance with your memorandum of September 14, 1982 we have reviewed your list of Diablo Canyon action items. Our comments and additions for your list are provided on enclosure 1. Enclosure 2 provides a detailed list of open issues resulting from Region V inspections of the Independent Design Verification Program. Consistent with our previous agreement, the list of open inspection issues has been reviewed with NRR:DE (Mr. J. P. Knight) and closure responsibilities (RV vs NRR) have been identified.

We will be glad to answer any questions you have regarding our comments (Contact: T. W. Bishop, FTS 463-3751).

R. H. Engelken  
Regional Administrator

cc w/enclosures:  
H. Denton  
R. DeYoung  
R. Vollmer  
T. Novak  
F. Miragua  
J. Kerrigan  
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Enclosure (1)

REGION V COMMENTS ON DIABLO CANYON ACTION ITEMS LIST

The comments below are in reference to the Action Items list provided as an enclosure to Mr. D. G. Eisenhut's memorandum to Messrs Engelken, Vollmer, and Mattson (dated September 14, 1982).

- Item No. 4      It is suggested that the IDVP be encouraged to expedite the reporting of the Phase II R. F. Reedy, QA findings so that they can use this information in conjunction with the BIR and PG&E self-appraisal to assure timely response to these issues.
- Item No. 5      Region V will review the scope of the proposed IDVP review of construction quality assurance when that proposal is provided. In addition, RV will monitor the execution of the review as it is doing for other aspects of the IDVP (see item 12 and new items 26, 27, and 28 below).
- Item No. 10     Region V will comparatively evaluate the scope of modifications resulting from IE Bulletin 79-14 for Diablo Canyon, Trojan, and Rancho Seco.
- Item No. 11     No specific Region V action on this item appears necessary at this time. It is recognized by all parties that the Westinghouse interface with PG&E is an important issue. From discussions with IDVP members (R. F. Reedy) we are aware they have performed some reviews of this interface. However, to assure appropriate attention to this issue it is recommended that NRR issue written correspondence to the IDVP Contractor (Teledyne) assuring their thorough review of this area.
- Item No. 12     Region V has attended the exit interview of PG&E Internal QA. Regional comments on this subject were provided to NRR by R. H. Engelken memorandum of September 15, 1982.
- Item No. 13     Region V has developed an itemized list of open items resulting from inspections of IDVP activities. This list has been reviewed by NRR:DE (Mr. J. P. Knight) who agreed to the closure responsibilities. This information is provided on enclosure 2.
- Item No. 22     Region V will evaluate the PG&E statements regarding the confidence provided by the pre-op test program for nonseismic safety related design contracts.

New Item No. 26

Verification of Independence for Technical Reviewers

Examinations are based on the independence criteria in Chairman Palladino's letter to Congressmen Ottinger and Dingell as well as the approved program plan for Phase I of the IDVP which contains the procedure for Teledyne to assure independence and to complete the "independence statements". Inspection will include examinations of selected technical reviewer's "independence statements"; selective examination of employment records and resumes to confirm "independence statements"; selective interviews with technical reviewers to confirm, "independence statements" are conducted to assess the reviewer's independence and freedom to fully explore concerns.  
Responsibility: Region V

New Item No. 27

Examination of Procedures for Controlling Work Activities and their Implementation

Examination of selected procedures and implementation to verify consistency with the approved program plans and PG&E/Bechtel Quality Assurance Program.  
Responsibility: Region V

New Item No. 28

Examination of Plant Modifications

Verification that plant modifications are accomplished in accordance with approved design documents and in accordance with established quality requirements. Examination shall involve a large percentage of field modifications and shall include physical inspection of modifications and review of quality related records.  
Responsibility: Region V

New Item No. 29

Evaluate Results of IDVP Construction QA Review

Responsibility: NRR

Enclosure 2  
Diablo Canyon IDVP Open Inspection Issues  
and closure responsibilities

1. Region 5 inspection report 50-275/82-02 dated 3/31/82.

The inspector found the seismic spectra for the auxiliary building to be out of date and incorrect in that subsequent URS/Blume analyses (October 1979 report) corrected the omission of soil springs at elevation 100'. The staff should verify that the soil springs were correctly modeled and included in the final analysis of the Auxiliary building and that qualifications of components and equipment above elevation 100' are reviewed for adequacy with technically correct criteria.

CLOSURE RESPONSIBILITY: NRR

2. Region 5 inspection report 50-275/82-20 dated June 29, 1982.

- (a) The inspector was informed (during the inspection) that the TES Hayward office would not become involved in technical reviews. Recent conversations with TES personnel indicate that this situation may change. The staff may have to review some records and interview personnel at the TES Hayward offices. (NO ACTION REQUIRED)
- (b) The inspectors observed that PG&E procedure P-19 had different criteria for measurement tolerances of piping and piping support systems than the IE Bulletin 79-14 walkdown tolerances contained in PG&E procedure P-11. PG&E personnel committed to revise the procedures and document the bases of any differences between them. The staff should examine these procedures and determine the acceptability of any differences remaining.  
CLOSURE RESPONSIBILITY: RV
- (c) The inspectors determined that TES had made changes to the IDVP plan (distribution of reports to PG&E) and had adopted a liberal interpretation of paragraph 10.3 of the IDVP plan. As requested by the inspector and NRR staff members present during the inspection, TES included their changes/positions in a letter from W. E. Cooper to H. R. Denton dated May 28, 1982. These changes (and subsequent changes such as the letter from W. E. Cooper to H. R. Denton dated August 5, 1982) should be examined and approved or questioned.  
CLOSURE RESPONSIBILITY: NRR
- (d) The inspector observed that equations 3 and 4 of the civil seismic design criteria memo (DCM C-17) require clarifications and that "Blume Internal Review" item TBO01 may be required for submittal to the NRC. The staff should examine equations 3 and 4 of the DCM as well as TBO01 for technical adequacy, completeness, and consistency with previous licensing documentation.  
CLOSURE RESPONSIBILITY: NRR

3. Trip Report K. S. Herring to F. Miraglia, dated February 3, 1982.

- a. Auxiliary Building:

- (i) 1977 Weight Discrepancy - The Cloud verification effort identified that a significant weight discrepancy of 35% between original Blume and later PG&E analyses existed at elevation 140'. The Blume calculation book indicated that discrepancies of about +16%, +9.6%, and -34% also existed at elevations 163', 115', and 100', respectively. The calculation book indicated that the original Blume weights were used in the analyses but gave no basis for this.

It appears that the use of these initial Blume weights in the Blume structural analyses was appropriate and not adequately documented in the initial calculations.

URS/Blume personnel stated that they had recently received a written explanation from PG&E describing that the weight discrepancy was due to an erroneous March 1977 run of the SHERWAL computer program and the lack of consideration of certain weights by the SHERWAL program. When a correct SHERWAL run was made, and the appropriate neglected weights were added to the SHERWAL weights, the weights compare well with those used by Blume in its Auxiliary Building analyses. This was confirmed by PG&E personnel who further indicated that SHERWAL computed weights are used in conjunction with acceleration profiles from Blume's structural analyses to perform structural evaluations of walls. Although there are differences between the masses used in the SHERWAL analysis, and those actually present, PG&E personnel contended that the SHERWAL analysis results would not be significantly affected.

The staff should verify that the new seismic analyses of the Auxiliary building correctly take into account the masses of the structural elements and inertial forces generated by separately analyzed major components.

CLOSURE RESPONSIBILITY: NRR

- (ii) Elevation 100' Soil Spring Omission - Differences in spectra between the Hosgri Report N-S floor spectra for the Auxiliary Building and the final Blume report on the Auxiliary Building were identified by Cloud, and afterward found by the NRC to be attributed to an error in the incorporation of the soil spring at elevation 100' of the building model in the preliminary Blume analyses on which the FSAR (Hosgri Report) is based. This was corrected and included in the analysis on which the final report was based.

An October 1978 transmittal from Blume to PG&E regarding a Blume design review reported this soil spring error but concluded that when the spring is included in the analysis, "...the result leads to higher estimates of responses and is thus conservative." Recent information indicates that this statement is not true with regard to certain of the N-S floor response spectra for the Auxiliary Building.

The Blume calculation book contains results of an evaluation conducted between 1/78 and 5/78 to determine the effects of neglecting the soil spring since this was erroneously omitted in earlier analyses. The study concluded that the responses in the N-S direction were indeed affected by the presence of the soil spring. Comparisons of floor spectra with and without inclusion of the soil spring were presented which indicated certain areas of the floor spectra were greater when the soil spring was included, especially for torsional response, and certain areas were lower. The calculation book indicated with no stated basis that this analysis was not used. The person at Blume who originated the 10/78 transmittal stated that (1) he was not aware of the 1/78-5/78 study and (2) that although his 10/78 conclusions addressed "responses", he was referring only to building forces and peak structural responses not floor response spectra. It appears that this error was caused by (1) inadequate personnel interfaces within Blume, and (2) lack of sufficient consideration, by Blume personnel, of PG&E use of floor spectra in their piping and equipment evaluations.

The staff should verify that the new Auxiliary building seismic analysis properly models and includes the soil springs. Qualification procedures for components and equipment above elevation 100' should be examined for technical adequacy. (This is essentially the same as item 1).

CLOSURE RESPONSIBILITY: NRR

b. Intake Structure:

Use of Inappropriate Spectra for PG&E Evaluations - All preliminary and the final Blume reports regarding the Intake Structure indicated that the response spectra for the design of equipment at the roof level were similar to the ground spectra for most areas of the roof. No spectra were supplied in these reports and PG&E has used the ground spectra for its evaluations of all areas of the Intake Structure, including the roof. Spectra at several points at the roof were contained in the Blume calculation book for this structure. One of these points was at the roof area above the Auxiliary Saltwater Pumps. These spectra indicated significant spectral peaks in the 20-25 Hz range which are not present in the ground spectra. Blume personnel indicated that PG&E had only recently requested these spectra and that Blume was now in the process of peak broadening them for transmittal to PG&E. The PG&E review of the preliminary and final Blume reports on the Intake Structure was not sufficient to detect this issue earlier.

The staff should examine these spectra developed by URS/Blume and any additional seismic evaluation/analyses completed by Bechtel to verify that the safety related components and structures of the intake structure are not affected and require no modifications.

CLOSURE RESPONSIBILITY: NRR

c. Containment Polar Crane:

- (i) Polar Crane Analyses - The docketed FSAR (Hosgri Report) concerning the structural analyses and integrity of the Containment Polar Crane contains the results of the URS/Blume 2-D nonlinear and 3-D linear elastic analyses of the polar crane. Results of these analyses (as relied upon by the NRC in Supplement 9 to its SER) indicated that the interaction ratios for stresses in the polar crane members are all less than 1.0; therefore, no overstresses are predicted. A later 3-D nonlinear analysis of this crane was performed by URS/Blume and the results provided to PG&E by Blume in a report dated July, 1979. This latter analysis indicated the potential for interaction ratios as high as 1.3 in the crane support columns, which is an overstress. The Blume report concluded that this was acceptable since it was localized and there was only one peak load excursion.

Blume calculations considered the time phasing of loads and used actual average material properties to evaluate these members in the absence of the normal AISC Code margins. Also, load time histories for these members contained in the Blume calculation book indicated that while there was only one peak load excursion, the potential existed for several in the range of 80-90% of the peak. This analysis was disregarded and not docketed by PG&E regarding the structural integrity analyses. PG&E personnel indicated that when they received the July 1979 Blume report, a comprehensive review of the report was not conducted since the Blume conclusion that no modifications to the crane were required was not changed from previous reports. The PG&E review of the July 1979 Blume report was not sufficient to conclude that this report demonstrated that the analyses results presented in the FSAR were significantly less conservative than those contained therein and, therefore, may warrant further evaluation.

The staff should examine the final polar crane configuration (including anti-rocking devices), seismic analyses used for qualification, and interaction ratios derived from the analyses to verify the technical adequacy, completeness and consistency with licensing commitments.

CLOSURE RESPONSIBILITY: NRR

- (ii) Dome Service Crane - The dome service crane analyses being performed by PG&E incorporate undocketed 3-D nonlinear Polar Crane analyses results which have not been reviewed by the NRC (see above discussion of the Polar Crane Analyses).

The staff should examine the technical adequacy of this crane similar to the evaluation of the containment Polar Crane review.

CLOSURE RESPONSIBILITY: NRR

4. Trip Report K. S. Herring and J. R. Fair to F. Miraglia, dated March 3, 1982

(a) RLCA inspection piping and supports:

The piping analysis procedures, signed on 2/22/82, have been reviewed. The procedures were based on criteria presented in Section 8.2 of the Hosgri Report with additional criteria for overlap (NUREG/CR-1980), decoupling (piping diameter ratio 4) and small diameter piping connected to large pipe (either (1) large pipe response in the span where the attachment point is located is greater than 20Hz or (2) the large line displacement 1/16 inch). The procedures did not include the load combination or stress allowable criteria.

Two of the R. L. Cloud employees performing piping analyses were interviewed. These employees were familiar with the piping analysis procedures and criteria.

Approved support evaluation procedures were not available at the time of the inspection. The support frequency calculations were available but they had not been approved at the time of the inspection. The results of these calculations showed 19 of the 20 supports met the PG&E criteria for frequency as reported in the R. L. Cloud progress report dated January 9, 1982. Review of the calculations showed that snubber flexibilities had not been included in the computations. Cloud employees stated that these calculations had not been approved and the snubber flexibilities would be included in the final calculations.

The staff should verify that appropriate snubber flexibilities are included in the final RLCA calculations.

CLOSURE RESPONSIBILITY: NRR

(b) RLCA inspection - Equipment Calculation Review

The only completed, checked and approved calculation packages examined were those for the Main Annunciator Cabinet located in the Cable Spreading Room and the Diesel Generator Fuel Oil Priming Tank. Review of these calculations indicated the following.

- (i) Main Annunciator Cabinet - In the calculation of the cabinet response, 1) 12 ga. sheet metal side panels (25" x 35") were treated as simple beams without verification of the appropriateness of this assumption, 2) angle structural members were treated as simple beams without appropriate consideration of torsion, and 3) the locations of the centroids of the angles were computed erroneously. The last error was found to be due to an error in the handbook used for calculations, however, it appeared that insufficient consideration was given to the applicability of handbook formulas and

the basic assumptions ingrained in handbook and simple beam formula formulations. Dr. Cloud agreed that the calculation should be redone. He further indicated that this calculation, in addition to 3 others, had been performed by EDAC under a previous, since cancelled, subcontract. These other calculations were found to be inappropriate by Cloud personnel and were being redone. The cabinet calculation was not checked in as much detail as the other 3 since it indicated that an EOI was to be generated. Therefore, he felt that this was an isolated occurrence of an approval of an erroneous calculation.

From a visual inspection of this panel, it was observed that:

- a) The conception of this cabinet ingrained in the Cloud analyses was more representative of the physical configuration than that ingrained in recent PG&E evaluations.
  - b) The analysis performed recently by PG&E contained several assumptions which were not representative of the physical situation.
  - c) Several loose and missing bolts were obvious.
- (ii) Diesel Fuel Oil Priming Tank - No obvious errors were detected in the review of this calculation. However, insufficient attention was given in the evaluation of the concrete anchor bolts used for the supports. This appeared to be due to the low magnitude of the calculated seismic responses, however, we indicated to Cloud that these should be appropriately evaluated in all future calculations.

Given that an error was found in 1 of the 2 completed equipment calculations reviewed, it is recommended that the NRC staff review additional completed equipment calculations to determine whether or not this is an isolated case. In addition, it was observed that procedures for performing the analyses of all items in the Cloud verification effort have not yet been finalized by Cloud. The staff should verify that these procedures are finalized and technically satisfactory.

CLOSURE RESPONSIBILITY: NRR

(c) PG&E Inspection - Civil Engineering Related Calculations

Several topics related to the calculations performed by the PG&E and Blume Civil Engineering personnel were discussed. These discussions are described below and should be followed up to verify the adequacy of analyses completed or positions taken by the licensee.

CLOSURE RESPONSIBILITY: NRR

- (i) Containment Polar Crane - Discussions similar to those which took place on January 29, 1982, between Mr. Herring and PG&E and Blume personnel were reported. Since that first discussion, PG&E had no new information relative to this issue and indicated that they intended to pursue it further. The methodology and technical basis for the Polar Crane analyses should be verified by the staff.
- (ii) Containment Internal Structure Response Above Elevation 140' - The steam generator and pressurizer enclosures which extend about 40 feet above the operating deck (el. 140') were not modeled in the containment structural model. Therefore, floor spectra at el. 140' were used for the design of piping and equipment attached above el. 140' and coupled to these enclosures. The effects of the enclosure flexibility are being evaluated. They indicated that affected items include Main Steam and Containment Spray piping, and the safety and power operated relief valves. The analysis of the Containment Polar Crane in the parked and locked position (at the tops of the steam generator enclosures) is also affected since the flexibility of these enclosures was not considered in Blume's analyses of this crane.

From a visual inspection of these structures, the potential for further amplification of motion above el. 140' appeared obvious, especially considering the connection of the Polar Crane to the steam generator enclosures.

- (iii) Containment Pipeway - This steel frame structure, attached to the containment shell exterior, was initially assumed rigid. It appears that this assumption is not valid and the effects of its flexibility are being investigated. PG&E indicated that items affected include the Main Steam, Main Feedwater and Auxiliary Feedwater piping, and the Main Steam Isolation Valves.
- (iv) Main Annunciator Cabinet - PG&E is analyzing the cabinet flexibility in light of Cloud's finding that it was not rigid as assumed initially. They indicated that their preliminary calculations were demonstrating that the cabinet was rigid. However, the PG&E personnel performing the analyses were not aware of the connection details for the doors, internal member and cabinet supports to substantiate the validity of the assumptions made in their analyses.
- (v) Containment Exhaust Vent Structure Flexibility - Blume initially determined (November, 1970) that the exhaust vent had a natural frequency of 50 Hz and notified PG&E of this fact. In December, 1970, Blume determined that the 50 Hz was in error and that the frequency was 2 Hz. However, they never

notified PG&E of this change. Hosgri evaluations done by PG&E relied upon the 50 Hz frequency and determined that the vent would remain elastic. PG&E states that with a 2 Hz natural frequency, recent evaluations indicate that modifications are required for the vent to remain elastic under the Hosgri criteria and they are evaluating the feasibility of a non-linear analysis to demonstrate acceptability without modification.

From a visual inspection of this structure, it appeared obvious that the natural frequencies were substantially lower than the 50 Hz calculated initially by Blume, and used by PG&E in its Hosgri evaluation of this structure.

- (vi) Annulus Spectra Revisions - Three revisions to the containment annulus spectra have occurred since the initial discovery of the annulus problem. The first accounted for appropriate orientation, and the second accounted for appropriate mass and stiffness distributions. PG&E indicated that the latest revision has been necessitated by Blume discovering (in a recent internal Blume design audit) that the upper vertical masses of the internal structure in the initial Hosgri analyses inappropriately included such items as the Steam Generator, Reactor and Reactor Coolant Pumps. In addition, the two masses of the internal structure were transposed in the recent evaluations.

(d) PG&E Inspection - Piping Design and Construction

Recent R. L. Cloud progress reports have identified several as-built discrepancies during piping walk-downs. One issue identified was valve operator orientation. Correct measurements of valve operator orientations apparently were not made during the IE Bulletin 79-14 walk-downs. PG&E currently plans to walk-down all piping to record correct valve orientations.

According to PG&E the majority of the as-built dimensional discrepancies identified by Cloud were errors in drafting and not in the analyses. PG&E stated that the original piping drawings that were marked-up during the field as-built walk-downs were used by the piping analysts. These drawings were then sent to the drafting department to develop the final isometrics. These drawings were not treated as record drawings and therefore, were not subject to stringent quality control procedures. PG&E currently plans to upgrade the drawing controls on the piping isometric drawings and they also plan to perform a sample of 17 walk-downs to the IEB 79-14 criteria. This effort will require NRC staff review when PG&E completes the current evaluations on all open items.

CLOSURE RESPONSIBILITY: RV

5. Trip Report K. S. Herring to F. J. Miraglia, dated July 21, 1982

(a) PG&E Inspection - Blume Internal Review (BIR)

The BIR was conducted by Blume at the direction of PG&E. The purpose of the BIR was to have a group of internal Blume personnel who had not worked on Diablo Canyon in the past conduct a review of all Hosgri structural analyses previously performed by Blume to determine their adequacy to predict the behavior of the as-built Diablo Canyon safety-related structures. In this effort, Blume engineers reviewed the previous Hosgri structural analyses performed by Blume and generated comments regarding their adequacy. These comments were reviewed by a Blume supervisor and passed to the BIR Advisory Committee, chaired by Dr. Blume, for review. When all parties in this process were satisfied, the comments and evaluations were forwarded to PG&E. PG&E is responsible for final resolution of items requiring further evaluation, unless such items are a subject of the Independent Design Verification Program (IDVP) managed by Teledyne.

At the time of the inspection, the program had not been completed. The BIR report was still under preparation, and additional evaluations with regard to the BIR were still being conducted. PG&E indicated that a total of 150 comments had resulted from the BIR. PG&E was able to provide 147 of the comment packages in various stages of resolution for my review. The three additional BIR comments were still under preparation.

A cursory inspection of the 147 comments was conducted to gain an insight into the nature and depth of the BIR and associated PG&E program for comment resolution. The comments ranged in content from relatively minor discrepancies to those which required substantial additional effort to determine their significance. Based upon review and discussions with PG&E, it appeared that these comments were about equally distributed in three major significance categories, namely, 1) those insignificant by inspection, 2) those found to be insignificant or expected to be found insignificant after additional analysis and/or evaluation, and 3) those which were significant and required additional analysis and evaluations to determine their impacts.

From the inspection of the 147 BIR comments, it appears that Blume generally performed a thorough review of its previous Diablo Canyon Hosgri structural analyses. PG&E has implemented an organized program for BIR comment resolution which provides a necessary formal process for PG&E to supply Blume additional information and comments to allow for accuracy in the BIR determinations. The adequacy of this entire effort can only be ascertained after review of the final BIR report, and PG&E's and/or Teledyne's

final evaluation of the individual findings. PG&E indicated that they do not plan to submit the BIR final report to the NRC. Details will be submitted for only those items which become part of the Verification Program via entry into the PG&E tracking system. Therefore, a review of this report and associated PG&E comment dispositions should be conducted at the PG&E offices by the staff.

Only two potential concerns were noted in the review of the 147 comments and any associated resolutions, and these were discussed with PG&E. The first concern was that information associated with BIR comments AB 018 and TB 006 indicated that figures in Blume reports were inaccurately labeled. The BIR comments were dismissed essentially because the inaccuracies did not materially affect any analyses. The inspector cautioned that future ramifications of such inaccuracies must be carefully considered. The second concern was that the resolutions associated with BIR comments CE 022 and IS 007 did not document the resolution of all the reviewer's comments. The inspector indicated that PG&E should ensure that resolution of all review comments are clearly documented in all final packages. The staff should follow up these items to ensure that PG&E has dealt with them adequately. These are the same as item 2.D.

CLOSURE RESPONSIBILITY: NRR

(b) PG&E Inspection - Response Spectra Document Control Manual (DCM)

The inspector reviewed PG&E DCM No. 17, Revision 0, dated 04/19/82. This contained all the Hosgri response spectra to be used for design and evaluation of safety-related structures, systems and components. As a controlled document, revisions to spectra circulated to the appropriate PG&E supervisory personnel responsible for the analysis of the various structures, systems and components, and requires their signature to indicate that they have noted the revisions. In addition to containing the spectra, this DCM summarizes the way in which they are to be used. If spectra are not available at the point of attachment of a particular structure, system or component being designed or evaluated, the DCM requires that the Civil Engineering group specify the spectra, considering intermediate member or structure flexibility, as appropriate.

This DCM should avoid future problems with keeping track of the up to date response spectra and alleviate previous problems in this area. However, the inspector indicated that neither this DCM nor the associated Engineering Manual Procedure No. 3.2 clearly indicated a requirement that the appropriate supervisory personnel insure that the impact of spectra changes is assessed for existing safety-related structures, systems and components. PG&E indicated that functionally this was performed by the appropriate supervisors

in the fashion they felt was required. Given 1) the large number of response spectra, 2) the large number of items which would be potentially impacted by changes in spectra, and 3) the potential for changes in these spectra as a result of the current reverification effort, the inspector indicated that it would be prudent to have a clear requirement in the procedures to assess the effects of spectra changes. In addition, the inspector indicated that it may be prudent to have a formal procedure for each supervisor to follow. PG&E indicated that they felt that the former concern would most appropriately be addressed by a revision to Engineering Manual Procedure No. 3.2. Also, they indicated that they would carefully consider the need for implementation of the inspector's latter comment in light of already established procedures and practices.

These commitments should be followed up by the staff and the qualifications of equipment should be spot checked.

CLOSURE RESPONSIBILITY: NRR



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION V

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SEP 24 1982

MEMORANDUM FOR: D. G. Eisenhut, Director, Division of Licensing  
FROM: T. W. Bishop, Chief, Reactor Projects Branch No. 2  
SUBJECT: SUMMARY STATUS OF REGION V DIABLO CANYON ACTION ITEMS

In accordance with discussions held with you and members of your staff on September 20, 1982, we have developed summary status statements of Region V's action items related to the Diablo Canyon Verification Program. These statements are provided as enclosures to this memorandum. The statement item numbers are in reference to the Action Item list provided as an enclosure to your memorandum to Messrs. Engelken, Vollmer, and Mattson (dated September 14, 1982) and the Region V supplement dated September 17, 1982.

Please contact me (FTS 463-3751) if you have questions about the summary statements or require further information.

*T. W. Bishop*

T. W. Bishop, Chief  
Reactor Projects Branch No. 2

Enclosures:  
As stated

cc: w/enclosures  
R. H. Vollmer  
J. P. Knight  
J. D. Kerrigan  
H. E. Schierling

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ENCLOSURE

SUMMARY STATUS OF REGION V DIABLO CANYON ACTION ITEMS

The item numbering below is in reference to the Action Item List provided as an enclosure to Mr. D. G. Eisenhut's memorandum to Messrs. Engelken, Vollmer, and Mattson (dated September 14, 1982) and the Region V supplement dated September 17, 1982.

5. Review Proposed Program to Evaluate Construction Quality Assurance

Region V will review the scope of the proposed IDVP review of construction quality assurance when that proposal is provided.

12. Regional Review of PG&E Internal QA Review

Region V comments were previously provided to NRR (Memorandum from R. H. Engelken to D. G. Eisenhut, dated September 15, 1982).

13. Closeout of Open Items from Previous Region V Inspections

Remaining Region V actions relate to as-built verifications and Licensee action on IE Bulletin 79-14. These reviews will be completed when licensee activity in these areas has been formally documented. See item number 10 for a related discussion, and current licensee status.

Action Items 10, 22, 26, 27, and 28 are addressed on the following pages.

22. Pre-Operational Test Programs Relationship to Non-Seismic Safety Related Design Contracts

The licensee's preoperational test program is designed to demonstrate that the plant structures, systems, and components meet the appropriate design criteria for operation and are properly installed. The program includes tests, adjustments, calibrations, and system operations necessary to ensure satisfactory operation. The tests are designed to verify the performance of the components and system under conditions expected to be experienced during plant operation. Tests for which normal plant conditions are not available and cannot be simulated are tested to the maximum extent possible. Abnormal plant conditions are simulated during testing when possible. Simulated signals are used to verify the full operating range of the systems and to calibrate or align system instruments at these conditions.

The pre-operational tests of Diablo Canyon included verification of the operation of fluid, mechanical, and electrical systems based on acceptance criteria stated in the FSAR, process requirements, and manufacturers guarantees. These tests verify certain aspects of the engineering work and identify any shortcomings in design or construction which affect the acceptance criteria. For example, the hot functional testing includes evaluation and recording of the piping thermal movements as the reactor coolant, main steam, and ECCS systems are brought to operating temperature and pressure. Significant discrepancies in the expected thermal movement of piping is readily apparent and can be corrected prior to actually operating the plant. In the case of Diablo Canyon, system testing disclosed that the original thermal analysis of movement of the pressurizer relief lines was incorrect (because the lines were originally analyzed as being hot). Since the lines could be either hot (after a relief valve opens) or cold (normally) this required a reevaluation by the licensee's engineering personnel of this thermal analysis and a plant wide evaluation of where similar situations could occur. Another example is in the heating and ventilation system where the licensee developed the system design and logic of operation, but a contractor designed the electronics hardware to provide the design damper positioning logic. The design was checked by flow rate testing, filter efficiency testing, and checking of damper position. This verified PG&E's mechanical and logic design, the filter manufacturers mechanical design, and the contractor's electronics logic design. One last example is Westinghouse, who as NSSS vendor supplied the reactor coolant system, ECCS pumps, valves, heat exchangers, and logic cabinets. The Westinghouse equipment was integrated with the PG&E design to complete a functional NSSS package. The fact that the systems (such as ECCS) operated as designed during testing and that components (such as the RPS) functioned as designed gives added assurance that these areas of design have been satisfactorily completed.

In addition to the pre-operational testing, surveillance testing has been periodically conducted for some systems during the last five years. In some cases systems (like the Comp. Cooling Water System) have operated nearly continuously for this five year period. Any major system operational problem in these components or systems would have likely been identified by now.

As described above, it appears that "active" aspects of design such as flow rate, heat exchanger capacity, instrument set points, time to open or shut valves, loading of diesel generators, and set/reset points of relief valves are adequately verified by testing and operation of the plant. Conversely, upset design conditions may not be realistically tested and are not verified by pre-operational or surveillance testing. These conditions include: seismic events, pipe breaks outside containment, tornados, tsunamis, system operation in a steam-break environment, and certain pipe stresses. Satisfactory system operation under these upset conditions is verified through design analysis (frequently supplemented with laboratory testing). Errors in the design analyses involving upset conditions are sometimes detected when there is need to re-review the design (such as the block walls at the Trojan Plant) or when a design basis event occurs (storm waves damaging the Diablo Canyon Breakwater). For these reasons these types of analyses should receive the majority of the staff's attention in the design verification process.

26. Verification of Independence for Technical Reviewers

Region V has initiated a program to verify the independence of IDVP technical reviewers. The purpose of this program is to assure that the individuals performing the IDVP will provide an objective, dispassionate technical judgment, based solely on technical merit. The following factors were considered in evaluating the question of independence:

- 1) Whether the individuals involved had been previously hired by PG&E or Bechtel Power Corporation (BPC) to do similar design work.
- 2) Whether any individual involved had been previously employed by PG&E or BPC (and the nature of the employment).
- 3) Whether the individual owns or controls significant amounts of PG&E or BPC stock.
- 4) Whether members of the present household of individuals involved are employed by PG&E or BPC.
- 5) Whether any relatives are employed by PG&E or BPC in a management capacity.

The organizations involved in the IDVP (TES, Stone and Webster, Reedy, and Cloud) developed "conflict of interest statements" for their applicable employees to sign. The statements were used to screen the proposed participants for any potential or apparent conflicts of interest with respect to the IDVP. An exhibit of the TES conflict of interest statement is attached. Originally, the conflict of interest statements referred only to PG&E; however, Bechtel Power Corporation has recently been added to the statement. In addition to signing the original statements, the participants will be required to sign the revised statements reflecting the current Bechtel involvement in Diablo Canyon.

To verify that the individual participants meet the established independence criteria the staff has reviewed conflict of interest statements, reviewed resumes, and confidentially interviewed participants. The following is a summary of that effort.

a. Conflict of Interest Statements

The staff reviewed conflict of interest statements of all of the key TES participants (44 statements). These 44 statements included statements of six individuals employed by consultants to TES. The organizations that these individuals represent are: J. W. Wheaton Technology; Hansen, Holley, Biggs, Inc.; Alexander Kusko, Inc.; and Foster-Miller Associates. The conflict of interest statements signed by these individuals indicated that none of the individuals have any significant past or present involvement

with PG&E or Diablo Canyon. The conflict of interest statements did not include Bechtel Power Corporation. Recently, Bechtel has been added to the statements. The revised statements will be signed by the individuals involved.

In addition to the conflict of interest statements of the TES individuals, the staff has reviewed the conflict of interest statements of the Stone & Webster participants in the IDVP. Sixty-six conflict of interest statements were reviewed and included all of the Stone & Webster participants with the exception of two individuals whose statements were not available at the time of the review. The conflict of interest statements signed by these individuals indicated that none of the individuals have any significant past or present involvement with PG&E or Diablo Canyon. Similar to the TES conflict of interest statements, the Stone & Webster statements did not include Bechtel; the statements will be revised to include Bechtel and will be resigned by the Stone & Webster participants.

Conflict of interest statements of Cloud and Reedy participants have not yet been reviewed.

b. Resumes

The professional resumes of key TES and Stone & Webster participants have been reviewed by the staff to give additional information regarding the question of independence. This effort included 34 resumes of TES personnel (including consultants) and 36 resumes of Stone & Webster personnel. The resumes indicated no employment history with either PG&E or Bechtel.

Additionally, the resumes were used to evaluate the professional experience and competence of the participants. The staff concluded that the TES and Stone & Webster individuals involved in the IDVP are competent and experienced in the matters under review.

c. Confidential Interviews

To further evaluate the question of independence, the staff selected key participants in the IDVP and conducted confidential interviews with them. This effort included interviews with thirteen TES personnel, nine Stone & Webster personnel, and approximately 50 percent of the Cloud participants from their West Coast office. In addition to the question of independence, the line of questioning by the Staff included the possibility of pressure being applied to suppress findings. Based on these interviews, the staff concluded that there is no conflict of interest between the participants in the IDVP and PG&E and Bechtel, and the participants feel no pressure to suppress possible findings.

Interviews with TES West Coast employees, Reedy employees, and Cloud East Coast employees have not yet been performed.

2. Financial Independence between TES and Bechtel and Stone & Webster and Bechtel

The staff discussed with the TES IDVP Project Manager and the TES Controller the extent of TES business with Bechtel. This discussion and review of the TES computer printout of current projects revealed that TES is currently involved in five projects with Bechtel (out of a total of 244 currently active projects). None of these five projects are related to Diablo Canyon. The fiscal year 1981 value of these Bechtel contracts is 1.234 million dollars. The total Teledyne corporate business for 1981 was 3237.6 million dollars, and although the company has a policy to not reveal division totals, the TES total annual business is estimated between 20 and 40 million dollars.

Staff interviews with Stone & Webster personnel indicated no contracts or financial connection between Stone & Webster and Bechtel.

Statement Regarding Potential or Apparent  
Conflicts of Interest

To: Teledyne Engineering Services

Whereas, the undersigned employee ("Employee") understands that he or she is being considered as a participant to provide services to Pacific Gas & Electric Company with respect to the Design Reverification Program for the Diablo Canyon Nuclear Power Plant - Unit 1; and

Whereas, Employee understands that it is necessary that proposed participants be screened for any potential or apparent conflicts of interest with respect to this assignment;

Therefore, for the above stated purposes Employee makes the following representations to Teledyne Engineering Services:

1. Employee has not engaged in any work or business involved with or related to the engineering or design of the Diablo Canyon Nuclear Power Plant;
2. Neither Employee, nor any member of his or her immediate family, own any beneficial interest in the Pacific Gas & Electric Company and/or the Bechtel Power Corporation, including but not limited to common or preferred stocks, bonds or other securities issued on behalf of the Pacific Gas & Electric Company and/or the Bechtel Power Corporation; and
3. None of the members of Employee's immediate family are employed by Pacific Gas & Electric Company and/or Bechtel Power Corporation.

This statement is based upon the Employee's best information and belief and any exceptions to representations contained herein have been described on the reverse side of this document.

Dated: \_\_\_\_\_

Signature: \_\_\_\_\_

\_\_\_\_\_  
Print Name

27. Examination of Procedures for Controlling Work Activities and their Implementation.

In November 1981 the Region V staff initiated inspections of the licensee's and IDVP participants' work activities and the associated implementing procedures for controlling the work activities. The purpose of this inspection effort is to: (1) verify that appropriate procedures have been developed to control licensee and IDVP work activities; (2) verify that these procedures are consistent with licensee commitments and regulatory requirements, and; (3) verify that the procedures are being followed. Close coordination with NRR has been maintained by joint NRR and Region V inspections at Pacific Gas and Electric Company, R. L. Cloud and Associates, and Teledyne Engineering Services, Incorporated. The initial inspections were based on commitments such as those made during the October 9, 1981 and November 3, 1981 meetings with the licensee. Subsequent inspections were also based on program plans such as the R. L. Cloud and Associates Phase I plans dated December 3, 1981 and February 27, 1982 and later the Teledyne Engineering Services approved Phase I plan dated March 29, 1982 as well as the Phase II plan dated June 18, 1982.

The initial phase of the inspection effort consisted of examinations of procedures against the commitments and correspondence related to the subject matter (such as a Program plan or QA manual) to determine if the commitments and plans were implemented by appropriate directives. The inspectors then interview personnel (technical, clerical, and supervisory), audit records, and examine work in progress to determine if the procedures were followed. Special emphasis has been placed on the control of information between PG&E/Bechtel and the IDVP organizations the tracking of identified issues, the completion of modifications, and individual awareness of the program requirements. These inspections have included examinations of Teledyne, R. L. Cloud, Stone & Webster, R. F. Reedy (procedures and results only), and the licensee. The inspections have been documented in memoranda, inspection reports (82-02, 82-05, 82-20 and 82-30) and trip reports (Reports/Memos dated January 15, 1982, February 3, 1982, March 2, 1982 and July 21, 1982, September 15, 1982).

Based on inspection findings to date it appears that IDVP and licensee actions are currently being adequately controlled. Appropriate procedures have been developed and are being satisfactorily implemented. Issues raised by the staff during the inspections are being properly resolved by the licensee or IDVP organization. The most significant open issue at this time relates to the exchange of information (written documents and meetings) between PG&E and the IDVP organizations. Teledyne submitted their position on this issue on August 5, 1982. The submittal is currently under NRR staff review.

## 28. Examination of Plant Modifications

The Independent Design Verification Program and the licensee's Internal Technical Program have resulted in a number of modifications to date. The majority of the modifications have been made to restore safety margins lost due to errors in the seismic design process. The licensee has stated that the plant, without modifications, would withstand the effects of a postulated Hosgri earthquake without loss of intended safety functions. The staff has not verified the accuracy of this statement.

The required seismic modifications identified as of September 10, 1982 include the following:

- annulus structural steel strengthening (27 of 810 connections and 11 of 405 members)
- pipe support strengthening (258 supports)
- electrical raceway support strengthening (145 supports)
- annunciator cabinet stiffening
- containment fan cooler support weld (one weld)
- valve yoke stiffening (one valve)
- instrument tubing support strengthening (four supports)

One non-seismic modification has been specified to date. This modification involves the installation of larger capacity circuit breakers in the 125V DC electrical system (6 incorrectly sized breakers were installed).

In addition to the above, the licensee anticipates further modifications will be required, as described below:

- Fuel Handling Building structural modifications
- containment polar and dome service crane guide strut and clamp modification
- strengthening of various pipe supports (estimating 20% of supports will require modification)
- strengthening of various electrical raceway supports
- strengthening of various HVAC supports
- strengthening of various equipment supports
- restoration of redundant power supplies to control room HVAC (non-seismic)

Region V has established a program for the examination of modification activity. It is the purpose of the program to verify that plant modifications are accomplished in accordance with approved design documents and in accordance with established quality requirements. The examination involves a large percentage of the field modifications and includes physical inspection of the hardware and review of quality related records.

To date, Regional inspections of modifications have centered on large and small bore pipe supports, electrical raceway supports, instrument tubing supports and the repairs made to the containment fan cooler support weld. As of September 10, 1982, the licensee has released design modifications for 179 large bore and 79 small bore pipe supports. To date, 82 (46%) large supports and 62 (78%) small bore supports have been inspected by Region V. The licensee has modified 145 raceway supports of which 97 (67%) have been inspected by Region V. Inspection results to date have shown that, in general, the modifications are being accomplished in a controlled manner to high quality standards.

10. Comparison of IE Bulletin 79-14 Actions for Diablo Canyon, Trojan and Rancho Seco

In response to IE Bulletin 79-14 "Seismic Analyses for As-Built Safety Related Piping Systems" Licensees were required to develop a verification program, examine safety related systems for nonconformances, evaluate and report all nonconformances to the NRC, modify the plant if required, and correct the documents which describe the as-built condition of the plant. Generally, the piping systems are depicted on piping isometric diagrams (isometrics) and on plant area drawings. The isometric drawings are used to formulate the input to computer calculations of the thermal and seismic stresses as well as the forces acting on pipe restraints and supports. Often two or more computer calculations are done (i.e. thermal and seismic) for each piping system. Depending upon the computer program and amount of the piping system on an isometric, a portion, one, or several, isometrics may be included in one piping computer calculation (problem). Since the licensees had different plant designs, different computer codes, different technical approaches, and chose to use different thresholds for evaluation it would be inappropriate to depend too heavily on any comparison of the relative error rate. A review of the IEB 79-14 correspondence revealed the following information.

Pacific Gas and Electric Company's (PG&E) original design utilized a total of 131 safety related piping isometrics and 222 safety related piping problems. As a result of IE Bulletin 79-14, 57 of the problems were reanalyzed and approximately 20 piping supports were modified. At the same time 14 field hardware changes were made to correct other deficiencies found when the piping system walkdowns were completed.

For the Rancho Seco plant the Sacramento Municipal Utility District's (SMUD) original design utilized 72 isometrics and 54 safety related piping problems. As a result of IE Bulletin 79-14, 9 of the problems were reanalyzed and approximately 10 modifications were made to the pipe supports.

In the case of the Trojan plant, Portland General Electric (PGE) Company's original design utilized a total of 542 safety related isometrics. As a result of IE Bulletin 79-14, 189 isometrics and an undisclosed number of piping problems were reanalyzed. As a result, 83 pipe supports were modified by minor stiffing or adding a brace. Three additional supports were also added, approximately 75 drawing changes were also required, and 9 valves required seismic reanalysis.

Based on this limited data, computation of the percent of problems or isometrics reanalyzed in response to IE Bulletin 79-14 were 17% for Rancho Seco, 26% for Diablo Canyon, and 35% for Trojan. However, as stated previously, because of the significant differences in the three plant's designs and design processes (technical approaches, computer programs, numbers of isometrics used, etc.) the use of this limited data to infer an accurate comparative error rate is inappropriate. A significant records research effort would be required by the three licensees if an accurate error rate was to be determined.

The type of errors found in the PG&E work during the last year which are related to IEB 79-14 can be divided into three broad categories.

- Information incorrectly transferred from walkdown isometrics to record copy isometrics: These errors reportedly did not affect the piping analyses, but do reflect a failure of the licensee to satisfactorily complete a commitment to the NRC.
- Pipe support, elbows, or branch connection locations outside the walkdown tolerances; these are generally Teledyne type "C" errors and have no effect on design.
- Walkdown errors; Examples are valve orientation or restraint orientation.

According to the licensee the majority of the as-built dimensional discrepancies identified by the IDVP were errors in drafting and not in the analyses. However, correct measurements of valve operator orientations apparently were not made during the IE Bulletin 79-14 walk-downs. PG&E currently plans to walk-down all piping to record correct valve orientations. PG&E stated that the original piping drawings that were marked-up during the field as-built walk-downs were used by the piping analysts. These drawings were then sent to the drafting department to develop the final isometrics. These drawings were not treated as record drawings and therefore, were not subject to stringent quality control procedures. PG&E currently plans to upgrade the drawing controls on the piping isometric drawings and they also plan to perform a sample of 17 walk-downs to the IEB 79-14 criteria. Licensee personnel have also stated that they expect to reanalyze the piping problems to verify their engineering judgment and to correct the identified deficiencies. This effort will require NRC staff review when the licensee completes the current evaluations.