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77 BEALE STREET, SAN FRANCISCO, CALIFORNIA 94106  
P. O. BOX 7442, SAN FRANCISCO, CALIFORNIA 94120

82 JUL 12 12:25  
TELEPHONE (415) 781-4211  
TELECOPIER (415) 543-7813

OFFICE OF SECRETARY  
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July 8, 1982 BRANCH

Dr. William Cooper  
Teledyne Engineering Services  
130 Second Avenue  
Waltham, Massachusetts 02254

Subject: BNL Report, Independent Seismic Evaluation  
of the Diablo Canyon Unit 1 Containment  
Annulus Structure and Selected Piping Systems

Dear Dr. Cooper:

Harold Denton's July 1, 1982, letter to you transmitted Brookhaven National Laboratory's final report entitled "Independent Seismic Evaluation of the Diablo Canyon Unit 1 Containment Annulus Structure and Selected Piping Systems". Mr. Denton's letter recommended that you consider the Brookhaven National Laboratory (BNL) report in the Phase I portion of the IDVP process. The letter identified seven items which, based upon the NRC Staff's initial review of the BNL report, required further exploration and assessment. Mr. Denton also requested that you inform the NRC Staff of your views regarding the validity of the BNL results and their generic implications.

We have made a preliminary review of the BNL report. The results are described below. As indicated in Mr. Denton's letter, there are several areas where the BNL report reaches different results than does PG&E. This is not surprising in analyses of this type, particularly in the absence of technical discussions between the parties. In the case of the BNL report, it appears that use of up-to-date information by BNL would have avoided most of the apparent differences.

Our preliminary views of the seven items, quoted from the Denton Letter, are as follows:

Item #1

"The distributed masses of the steel members comprising the annulus structure apparently were not included in the mathematical model used in the original seismic analysis."

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BNL's concerns appear to result from a comparison of BNL's model with the 1979 URS/Blume model. BNL, attempting to explain differences between its parametric solutions and results in the 1979 URS/Blume model, hypothesized that the distributed masses of the steel members were not included in the 1979 URS/Blume model (BNL Report, pages 7, 13, and 49). BNL rejected the possibility that these masses were included in the "lumped mass" portion of the model because BNL's estimate of the mass of the equipment alone exceeded the 1979 URS/Blume estimate of the total mass (BNL Report, Pages 13, and 50).

The 1979 URS/Blume model in fact included masses of the steel members in the lumped mass values. However, as reported to the NRC as long ago as November 3, 1981, there were inaccuracies in the mass data provided for use in the 1979 URS/Blume analyses (Transcript of November 3, 1981, meeting page 132; PGandE Bi-Weekly Status Report, November 13, 1981). In 1981/1982, the 1979 URS/Blume model was updated to more accurately represent the masses. The mass data used in the 1981/1982 URS/Blume model compare favorably with the BNL data. PGandE has also calculated the masses and these results (done in June 1982) are in essential agreement with the 1981/1982 URS/Blume data and the BNL data.

Thus, using current information, there appears to be no significant disagreement in this area.

#### Item #2

"The mathematical model used in the original analysis apparently considered the joints between the beams and columns to be rigid whereas the Brookhaven interpretation of the drawings indicate these joints are more appropriately considered flexible (shear carrying only)."

BNL's concerns here result from a comparison between BNL's model and the 1979 URS/Blume model relating to boundary conditions at beam ends. The BNL Model B (which BNL ascertained most closely represented actual field conditions), used rigid (moment) connections for the beam to column framings for the first and second levels and shear type joints for the third and fourth levels. (BNL Report, page 5.) While the 1979 URS/Blume model primarily used rigid beam to column connections, the model as revised in late 1981/1982 more realistically models actual connection details. The revised Blume model, like the BNL Model B, uses rigid connections on the first and second levels and shear connections on the third and fourth levels. Therefore, there is no disagreement in this area between URS/Blume and BNL.

#### Item #3

"Statements on page 11 of URS/Blume May 1979 report 'Diablo Canyon Nuclear Plant Unit 1 Containment Structure, Dynamic Seismic Analysis for 7.5 Hosgri Earthquake', May 1979, concerning the structural connections may not be consistent with the mathematical model used in the original analysis."

Page 11 of the URS/Blume 1979 Report "Containment Structure Dynamic Analysis for the 7.5M Hosgri Earthquake", states that "[t]he joints between the steel frames of the annulus structure and the crane wall were modeled as pin joints to conform to actual field conditions." BNL is correct in pointing out that this statement is inconsistent with the 1979 model itself. This can be seen from the Beam Data furnished to NRC with PGandE's April 26, 1982, letter and Figure 10 of the 1979 report. The model was revised in late 1981/1982 to more realistically model actual connection details. This revision removed the inconsistency pointed out by BNL. Therefore, there is no disagreement in this area between BNL and the most current URS/Blume analysis.

#### Item #4

"The original spectrum smoothing techniques employed in the original analyses appears inconsistent with the PSAR commitments."

The response spectrum smoothing procedures used for Diablo Canyon are consistent with PGandE's commitments to the NRC. For example, the "Diablo Canyon Specifications for Seismic Review of Major Structures for 7.5 Hosgri Earthquake, Revised February 8, 1977", states that spectra smoothing will be based on "smoothing lesser Hosgri peaks and valleys by free-hand averaging...". These procedures were reviewed and approved by the NRC Staff as shown in Supplement 7 to the Safety Evaluation report (dated May 1978). The smoothing procedure was described by the Staff as follows (Supplement 7 page 3-22):

"A modified procedure was used for smoothing the raw floor response spectra. For the reevaluation, smoothing was done by free-hand averaging of floor response spectra except at the peaks where it was widened by 15 percent on the low frequency side and five percent on the high frequency side without reduction of the peaks."

#### Item #5

"Design dimensions were apparently used instead of the as-built dimensions in the two piping problems sampled (PGandE piping models, 6-11 and 4A-26)."

Although we do not fully understand the issue raised by BNL (BNL Report, pages 11, 126, and 127), we suspect that it is related to Open Item 13 in PGandE's Semi-Monthly reports. This Open Item, first identified in January 1982, concerns inaccuracies in transposing field walkdown data from working drawings to as-built drawings. The correct data appearing on the latest as-built drawings is being incorporated into the PGandE piping analyses. This is an item which can perhaps best be resolved by direct discussions among PGandE, TES, and BNL.

#### Item #6

"The 5D bends in the piping analysis were apparently modelled as long radius bends. This has the effect of softening the model and reducing the natural frequencies."

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We agree with BNL's observations regarding the modelling of certain bends as long radius bends. This type of item is currently being addressed as part of the "79-14" walkdown reverification. We are prepared to discuss the significance of this issue with you.

Item #7

"The piping support forces computed by the BNL model are much larger than those computed by the PGandE model."

We are unable to address this issue without further information concerning BNL's analytical techniques. This is another item which would obviously benefit from direct discussions between PGandE, TES, and BNL.

We believe that it would be useful to schedule a meeting including TES, BNL, the NRC Staff, and PGandE in order to further clarify some of the items identified by Mr. Denton and to further explain PGandE's analysis. This would be consistent with Mr. Denton's invitation for you to use the NRC Project Manager to arrange for clarification of the BNL report. We would suggest a meeting take place during the week of July 19.

Sincerely,

G. A. Maneatis

cc: H. R. Denton, NRC  
R. H. Engelken, NRC Region V  
Service List