



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 17, 1989

DOCKET NOS.: 50-275
and 50-323

APPLICANT: PACIFIC GAS AND ELECTRIC COMPANY (PG&E)
FACILITY: DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2
SUBJECT: SUMMARY OF MARCH 1-3, 1989 PUBLIC MEETING TO DISCUSS
SEISMIC GROUND MOTION, DIABLO CANYON LONG TERM SEISMIC PROGRAM
(LTSP) (TAC NOS. 55305 AND 68049)

On March 1-3, 1989 the NRC staff and its consultants met with PG&E in San Francisco, California to discuss PG&E's response to the ground motion questions transmitted by the NRC staff letter of December 13, 1988, as part of the staff review of the LTSP Final Report submitted by PG&E on July 31, 1988.

Attendees at the meeting are given in Enclosures 1, 2, and 3. The agenda for the meeting is given in Enclosure 4. A copy of all the viewgraphs presented at the meeting have been transmitted to the meeting participants by PG&E letter dated March 13, 1989. This material has been docketed and is available for inspection at the PDR and the LPDR.

Following the formal presentations by PG&E and its consultants, the staff and its consultants caucused in the afternoon of March 2. As a result of the caucus the staff provided PG&E with list of questions and issues related to ground motion which still need clarification. Among these are:

1. What are the potential effects on the ground motion regression analysis results of including the very hard rock sites in the empirical data set.
2. Provide a justification of the methods used for the selection and adjustment of the data used in the near-source ground motion and empirical ground motion estimates. The justification should demonstrate that the methods used do not bias the ground motion to the low side.
3. Identify the records which were used in each of the subsets of the empirical data set used for each of the various analyses.
4. The median and 84% spectra resulting from the numerical modeling studies have a dip in amplitude between 5 and 10 Hertz. PG&E stated that this is an artifact of the random number set used in the calculations. Substantiate this by providing spectra generated with a different sets of random numbers where this dip does not occur.
5. How much would the empirical ground motion estimates change if the type of faulting was assumed to be all oblique slip rather than 65% strike slip, 30% oblique slip, and 5% reverse slip?
6. Is the apparent magnitude dependence of the dispersion in the empirical ground motion analysis real or is it an artifact of the data set? For lower magnitudes the uncertainty may be due to inter-event dispersion while at larger magnitudes it may be due to intra-event dispersion.

8903230362 890317
PDR ADOCK 05000275
P PDC

D

DF01
111

Memo 4
cc

7. Provide a step-by-step discussion of the uncertainty in the numerical modeling study.
8. Show the effect of different assumptions of fault type (strike slip, oblique slip, and reverse slip) in the numerical modeling study.
9. Provide a comparison between the numerical modeling study and the frequency-wave number method of the 1.5 km and 3 km source depth contributions.
10. Provide the eleven three-component time series for bilateral rupture for both the Imperial Valley and Coalinga aftershock sources from the numerical modeling study.
11. The amplitudes of low frequency portion of the spectra generated in the numerical modeling study appear to be deficient. At what frequencies are these spectra dependable?
12. To aid in accessing the proposed lack of topographic effect at the Diablo Canyon site, provide a numerical study using vertically polarized shear waves with ground motion amplitude referenced to sea level.

In the morning of March 3 PG&E made presentations and there were discussions on questions 2, 4, 5, 6, 7. PG&E will provide written submittals for the other items and to document the presentations on these five items.



Harry Rood, Senior Project Manager
Project Directorate V
Division of Reactor Projects - III,
IV, V and Special Projects

Enclosures:

1. Meeting Attendees, 3/1/89
2. Meeting Attendees, 3/2/89
3. Meeting Attendees, 3/3/89
4. Meeting Agenda

cc: w/enclosures - see next page

Mr. J. D. Shiffer
Pacific Gas and Electric Company

cc:

Richard F. Locke, Esq.
Pacific Gas & Electric Company
Post Office Box 7442
San Francisco, California 94120

Janice E. Kerr, Esq.
California Public Utilities Commission
350 McAllister Street
San Francisco, California 94102

Ms. Sandra A. Silver
660 Granite Creek Road
Santa Cruz, California 95065

Mr. W. C. Gangloff
Westinghouse Electric Corporation
P. O. Box 355
Pittsburgh, Pennsylvania 15230

Managing Editor
San Luis Obispo County Telegram
Tribune
1321 Johnson Avenue
P. O. Box 112
San Luis Obispo, California 93406

Mr. Leland M. Gustafson, Manager
Federal Relations
Pacific Gas and Electric Company
1726 M Street, N. W.
Washington, DC 20036-4502

Dian M. Grueneich
Marcia Preston
Law Office of Dian M. Grueneich
380 Hayes Street, Suite 4
San Francisco, California 94102

Diablo Canyon

NRC Resident Inspector
Diablo Canyon Nuclear Power Plant
c/o U.S. Nuclear Regulatory Commission
P. O. Box 369
Avila Beach, California 93424

Mr. Dick Blakenburg
Editor & Co-Publisher
South County Publishing Company
P. O. Box 460
Arroyo Grande, California 93420

Bruce Norton, Esq.
c/o Richard F. Locke, Esq.
Pacific Gas and Electric Company
Post Office Box 7442
San Francisco, California 94120

Dr. R. B. Ferguson
Sierra Club - Santa Lucia Chapter
Rocky Canyon Star Route
Creston, California 93432

Chairman
San Luis Obispo County Board of
Supervisors
Room 270
County Government Center
San Luis Obispo, California 93408

Director
Energy Facilities Siting Division
Energy Resources Conservation and
Development Commission
1516 9th Street
Sacramento, California 95814

Ms. Jacquelyn Wheeler
3033 Barranca Court
San Luis Obispo, California 93401



Pacific Gas & Electric Company

- 2 -

Diablo Canyon

CC:

Ms. Laurie McDermott, Coordinator
Consumers Organized for Defense
of Environmental Safety
731 Pacific Street, Suite 42
San Luis Obispo, California 93401

Mr. Paul Szalinski, Chief
Radiological Health Branch
State Department of Health
Services
714 P Street, Office Building #8
Sacramento, California 95814

Regional Administrator, Region V
U.S. Nuclear Regulatory Commission
1450 Maria Lane
Suite 210
Walnut Creek, California 94596

Ms. Nancy Culver
192 Luneta Street
San Luis Obispo, California 93401

President
California Public Utilities
Commission
California State Building
350 McAllister Street
San Francisco, California 94102

Michael M. Strumwasser, Esq.
Special Assistant Attorney General
State of California
Department of Justice
3580 Wilshire Boulevard, Room 800
Los Angeles, California 90010

Pacific Gas and Electric Company
Long Term Seismic Program

- 4 - Diablo Canyon

CC:

Dr. Keiiti Aki
Department of Geological Sciences
University Park
University of Southern California
Los Angeles, California 90089-0741

Dr. Ralph J. Archuleta
Department of Geological Sciences
University of California Santa Barbara
Santa Barbara, California 93106

Dr. Robert D. Brown, Jr.
U.S. Geological Survey
Mail Stop 977
345 Middlefield Road
Menlo Park, California 94025

Dr. David B. Slemmons
MacKay School of Mines
University of Nevada-Reno
Reno, Nevada 89557-0047

Dr. Robert Fitzpatrick
Building 130
Brookhaven National Laboratory
Upton, New York 11973

Dr. C. J. Costantino
Building 129
Brookhaven National Laboratory
Upton, New York 11973

Dr. Steven M. Day
Department of Geological Science
San Diego State University
San Diego, California 92182

Dr. George Gazetas
Dept. of Civil Engineering
212 Ketter Hall
SUNY-Buffalo
Buffalo, New York 14260

Dr. Jean Savy
Mail Code L-196
Lawrence Livermore National
Laboratory
P. O. Box 808
Livermore, California 94550

Dr. Anestis S. Veletsos
5211 Paisley Avenue
Houston, Texas 77096

Dr. Ken Campbell
U.S. Geological Survey
P. O. Box 25046, Mail Stop 966
Denver Federal Center
Denver, Colorado 80225



Pacific Gas and Electric Company
Long Term Seismic Program

- 5 - Diablo Canyon

cc:

Dr. Michael Bohn
Sandia Lab. - Organization 6412
Post Office Box 5800
Albuquerque, New Mexico 87185

Dr. M. K. Ravindra
EQE
3150 Bristol Street, Suite 350
Costa Mesa, California 92626

Dr. J. Johnson
EQE
595 Market Street - 18th Floor
San Francisco, California 94105

ENCLOSURE 1

ATTENDEES

Public Meeting on Seismic Ground Motion
Diablo Canyon Long Term Seismic Program
Wednesday, March 1, 1989

| <u>NAME</u> | <u>ORGANIZATION</u> |
|----------------------|--|
| Norm Abrahamson | Consultant to PG&E |
| K. Aki | University of Southern California (NRC) |
| Ralph J. Archuleta | University of California Santa Barbara (NRC) |
| Bruce Bolt | PG&E Consultant |
| Frank W. Brady | PG&E |
| D. A. Brand | PG&E |
| Kenneth Campbell | US Geological Survey - Golden (NRC) |
| Nilesh Chokshi | NRC/RES/PRAB |
| Lloyd S. Cluff | PG&E |
| Kevin J. Coppersmith | Geomatrix (PG&E) |
| James Davis | California Division of Mines & Geology |
| Steven M. Day | San Diego State University (NRC) |
| Don Helmberger | Consultant to PG&E |
| I. M. Idriss | Consultant to PG&E |
| J. J. Johnson | Consultant to NRC |
| Faiz Makdisi | Consultant to PG&E |
| Robin K. McGuire | Risk Engineering, Inc. (PG&E) |
| David W. Ogden | PG&E |
| David Ovadia | PG&E |
| Ben M. Page | Consultant to ACRS (NRC) |
| Harry Rood | NRC/NRR/PDV |
| Robert L. Rothman | NRC/NRR/EGSB |
| Ross Sadigh | Geomatrix (PG&E) |
| Bimal Sarkar | Bechtel (PG&E) |
| W. U. Savage | PG&E |
| Jean Savy | LLNL (NRC) |
| Paul Somerville | Consultant to PG&E |
| Yi-Ben Tsai | PG&E |
| Andy S. Veletsos | Rice University (BNL/NRC) |
| W. H. Wallace | PG&E |
| W. H. White | Bechtel (PG&E) |



ENCLOSURE 2

ATTENDEES

Public Meeting on Seismic Ground Motion
Diablo Canyon Long Term Seismic Program
Thursday, March 2, 1989

| <u>NAME</u> | <u>ORGANIZATION</u> |
|--------------------|--|
| Norm Abrahamson | Consultant to PG&E |
| K. Aki | University of Southern California (NRC) |
| Ralph J. Archuleta | University of California Santa Barbara (NRC) |
| Frank W. Brady | PG&E |
| Kenneth Campbell | US Geological Survey - Golden (NRC) |
| Nilesh Chokshi | NRC/RES/PRAB |
| Lloyd S. Cluff | PG&E |
| James Davis | California Division of Mines & Geology |
| Steven M. Day | San Diego State University (NRC) |
| Don Helmberger | Consultant to PG&E |
| I. M. Idriss | Consultant to PG&E |
| J. J. Johnson | Consultant to NRC |
| Faiz Makdisi | Consultant to PG&E |
| David W. Ogden | PG&E |
| Harry Rood | NRC/NRR/PDV |
| Robert L. Rothman | NRC/NRR/EGSB |
| Ross Sadigh | Geomatrix (PG&E) |
| Bimal Sarkar | Bechtel (PG&E) |
| W. U. Savage | PG&E |
| Jean Savy | LLNL (NRC) |
| Paul Somerville | Consultant to PG&E |
| Yi-Ben Tsai | PG&E |
| Andy S. Veletsos | Rice University (BNL/NRC) |
| W. H. White | Bechtel (PG&E) |



11/11/11

ENCLOSURE 3

ATTENDEES

Public Meeting on Seismic Ground Motion
Diablo Canyon Long Term Seismic Program
Friday, March 3, 1989

| <u>NAME</u> | <u>ORGANIZATION</u> |
|--------------------|--|
| Norm Abrahamson | Consultant to PG&E |
| K. Aki | University of Southern California (NRC) |
| Ralph J. Archuleta | University of California Santa Barbara (NRC) |
| Frank W. Brady | PG&E |
| Kenneth Campbell | US Geological Survey - Golden (NRC) |
| Nilesh Chokshi | NRC/RES/PRAB |
| Lloyd S. Cluff | PG&E |
| Steven M. Day | San Diego State University (NRC) |
| Don Helmberger | Consultant to PG&E |
| I. M. Idriss | Consultant to PG&E |
| Richard F. Locke | PG&E |
| Faiz Makdisi | Consultant to PG&E |
| David Ovadia | PG&E |
| Ben M. Page | Consultant to ACRS (NRC) |
| Harry Rood | NRC/NRR/PDV |
| Robert L. Rothman | NRC/NRR/EGSB |
| Ross Sadigh | Geomatrix (PG&E) |
| Bimal Sarkar | Bechtel (PG&E) |
| W. U. Savage | PG&E |
| Jean Savy | LLNL (NRC) |
| Harry Seed | Consultant to PG&E |
| Yi-Ben Tsai | PG&E |
| Andy S. Veletsos | Rice University (BNL/NRC) |
| W. H. Wallace | PG&E |



DIABLO CANYON LONG TERM SEISMIC PROGRAM
NRC/PG&E MEETING ON GROUND MOTIONS
ONE CALIFORNIA STREET, ROOM 271
SAN FRANCISCO, CALIFORNIA
MARCH 1 - 3, 1989

AGENDA

WEDNESDAY, MARCH 1, 1989

| | |
|------------|---|
| 8:00 a.m. | PG&E Pre-meeting Review - Room 271 |
| 8:00 a.m. | NRC Caucus - Room 202 |
| 8:15 a.m. | Introduction - NRC/PG&E |
| 8:25 a.m. | Empirical Ground Motion Studies - K. W. Campbell |
| 9:15 a.m. | Response Spectra Sensitivity Studies - A. S. Velétsos |
| 10:00 a.m. | Break |
| 10:15 a.m. | Review of Seismic Source Characterization |
| 10:30 a.m. | Review of Empirical Ground Motions Program (Questions 4, 23, and 28) |
| 11:30 a.m. | Discussion |
| 12:00 noon | Lunch |
| 1:00 p.m. | Questions and Responses (Questions 5 through 11, and 17 Parts (b) and (c)) |
| 2:45 p.m. | Break |
| 3:00 p.m. | Seismic Hazards (Ground Motion Aspects) |
| 3:45 p.m. | NRC Caucus |
| 4:30 p.m. | Discussion |



DIABLO CANYON LONG TERM SEISMIC PROGRAM
NRC/PG&E MEETING ON GROUND MOTIONS
ONE CALIFORNIA STREET, ROOM 271
SAN FRANCISCO, CALIFORNIA
MARCH 1 - 3, 1989

AGENDA

THURSDAY, MARCH 2, 1989

| | |
|------------|---|
| 8:00 a.m. | Overview of Numerical Modeling Method and Results |
| 8:45 a.m. | Questions and Responses (Questions 12 and 15) |
| 10:00 a.m. | Break |
| 10:15 a.m. | Questions and Responses (Questions 13, 14, 17 Part (a), & 20) |
| 12:00 noon | Lunch |
| 1:00 p.m. | Questions and Responses (Questions 13, 16, and 18) |
| 2:45 p.m. | Break |
| 3:00 p.m. | NRC Caucus |
| 3:30 p.m. | Discussion |

FRIDAY, MARCH 3, 1989

| | |
|-----------|---|
| 8:00 a.m. | Discussion and Summary of Ground Motions Resolution of Issues and Clarification of any Remaining Issues |
| | Closing Remarks |

March 17, 1989

- 2 -

7. Provide a step-by-step discussion of the uncertainty in the numerical modeling study.
8. Show the effect of different assumptions of fault type (strike slip, oblique slip, and reverse slip) in the numerical modeling study.
9. Provide a comparison between the numerical modeling study and the frequency-wave number method of the 1.5 km and 3 km source depth contributions.
10. Provide the eleven three-component time series for bilateral rupture for both the Imperial Valley and Coalinga aftershock sources from the numerical modeling study.
11. The amplitudes of low frequency portion of the spectra generated in the numerical modeling study appear to be deficient. At what frequencies are these spectra dependable?
12. To aid in accessing the proposed lack of topographic effect at the Diablo Canyon site, provide a numerical study using vertically polarized shear waves with ground motion amplitude referenced to sea level.

In the morning of March 3 PG&E made presentations and there were discussions on questions 2, 4, 5, 6, 7. PG&E stated that they will provide written submittals for the other items and will document the presentations on these five items.

/s/

Harry Rood, Senior Project Manager
Project Directorate V
Division of Reactor Projects - III,
IV, V and Special Projects

Enclosures:

1. Meeting Attendees, 3/1/89
2. Meeting Attendees, 3/2/89
3. Meeting Attendees, 3/3/89
4. Meeting Agenda

cc: w/enclosures - see next page

HR
DRSP/PD5
HRood
03/17/89

AK
DRSP/PD5
GKnighton
03/17/89

DISTRIBUTION

| | |
|-------------|-----------------|
| ACRS-10 | PDV Plant Files |
| NRG & LPDRs | OGC |
| GKnighton | EJordan |
| HRood | BGrimes |
| JLee | NChokshi |
| RRothman | LReiter |

DOCKET FILE
MVirgilio

1. The first of these is the fact that the...

2. The second is the fact that the...

3. The third is the fact that the...

4. The fourth is the fact that the...

5. The fifth is the fact that the...

6. The sixth is the fact that the...

7. The seventh is the fact that the...

8. The eighth is the fact that the...

9. The ninth is the fact that the...

10. The tenth is the fact that the...

11. The eleventh is the fact that the...

12. The twelfth is the fact that the...