Pacific Gas and Electric Company

Lawrence F. Womack
Vice President
Nuclear Services

Diablo Canyon Power Plant
P.O. Box 56
Avila Beach, CA 93424

805.545.4600
Fax: 805.545.4234

October 31, 2003

PG&E Letter No. DCL-03-141

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Special Report 03-03: Seismic Event of October 18, 2003

Dear Commissioners and Staff:

On October 18, 2003, at 0039 PDT, with Unit 1 and Unit 2 operating at 100 percent power, ground motion was felt and recognized as an earthquake by control room operators. The plant earthquake force monitor recorded greater than 0.01g for the seismic event. Therefore, operations personnel declared an Unusual Event. (Reference NRC Event Notification Number 40258.) At 0330 PDT, the Unusual Event was terminated upon confirmation that no damage to the plant occurred.

This special report is submitted pursuant to Diablo Canyon Power Plant (DCPP) Equipment Control Guideline (ECG) 51.1, "Seismic Instrumentation." This ECG requires the following actions for a seismic event: For seismic monitoring instruments actuated during a seismic event, "data shall be retrieved from actuated instruments and analyzed to determine the magnitude of the vibratory ground motion. A special report shall be prepared and submitted to the Commission ... describing the magnitude, frequency spectrum, and resultant effect upon facility features important to safety."

Enclosure 1 describes the ground motion analysis, including the magnitude and frequency spectrum of this event. Enclosure 2 provides an analysis of the resultant effect upon facility features important to safety.

As this event relates to DCPP, there was no adverse effect to public health and safety, or upon facility features important to safety. Peak acceleration recorded at the Unit 1 containment base for this event was 0.012g; DCPP is designed for peak accelerations of 0.75g horizontal and 0.50g vertical.

If you have any questions, please contact me at 805-545-4600 or Lloyd Cluff at 415-973-2791.

IE22
A025

Sincerely,

Lawrence F. Womack
Vice President – Nuclear Services

swh/A0593059
Enclosures
cc: Bruce S. Mallett, Region IV
David L. Proulx, Resident
Girija S. Shukla, NRR
Diablo Distribution

Diablo Canyon Power Plant
Deer Canyon Earthquakes of October 18, 2003

On October 18, 2003, at 0027 and 0039 PDT, two small local magnitude (M_L) 3.4 earthquakes occurred. The events were located approximately 5 km east of Diablo Canyon Power Plant (DCPP), in the region northwest of Deer Canyon. Both earthquakes were felt in the DCPP control room; the second event triggered strong motion instruments at the plant site. The earthquakes are part of a sequence of 14 small earthquakes that occurred between October 12 and October 24, 2003.

The earthquakes were recorded by the PG&E Central Coast Seismic Network (CCSN) that has operated since 1987 as part of the PG&E Long Term Seismic Program. The CCSN data are augmented by recordings from the U.S. Geological Survey's (USGS) Northern California Seismic Network (NCSN). The CCSN consists of 20 seismographic stations, including 5 dual-gain 3-component stations (large triangles in inset to Figure 1). The addition of the CCSN, including the 3-component stations greatly improves the accuracy of determining the earthquake location in the region around DCPP.

Figure 1 shows the Deer Canyon sequence with previous earthquakes for the period 1987 to the present. The October 2003 sequence consists of 14 earthquakes with magnitudes ranging from 0.4 to 3.4. The previous seismicity shows scattered activity across the San Luis/Pismo block; the Deer Canyon earthquakes are located within this region of previous activity (Figure 1).

Strong Ground Motion:

The two largest earthquakes were felt in the Unit 1 control room; the operators reported that the second event was the stronger. The first event did not trigger the seismic instruments. The second event did not trigger the Basic Seismic System analog recorder (Kinemetrics SMA) in the control room, however the Kinemetrics digital recorders (SSA) at the Unit 1 containment base, top of containment, the auxiliary building, and the free-field pit location (near the fitness trailer) did trigger on the second event. According to David Castleman of Kinemetrics, Inc., the SMA system worked properly; however, the system did not trigger because the containment base ground motions contained significant energy outside the 1.0 to 10.0 Hz bandwidth of the SMA trigger. An additional monitoring system, the Supplemental System, was inoperable at the time of the earthquakes; however, three temporary accelerometers (TerraTech GSR-18), located in the Auxiliary and the Turbine buildings, recorded the second event.

The earthquake force monitor (EFM) located in the control room measured 0.02g on the vertical component. The EFM measurement is from the sensor at the Unit 1 Containment base and does not have the DC offset removed. With the DC offset removed before filtering, the peak acceleration on the vertical component was 0.011g.

Table 2 lists the peak accelerations, peak velocities, and peak displacements of the free-field and Unit 1 containment base ground motions after the filtering and baseline corrections are applied. The peak accelerations ranged between about 1 to 2 percent g with the largest peak acceleration on the vertical component.

Regarding the frequency spectrum, the response spectra were computed for the free-field and Unit 1 containment base recordings. The 5 percent damped spectra for the free-field and Unit 1 containment base recordings are shown in Figures 2 and 3, respectively. The response spectra for this earthquake show very high frequency content that is typical for an earthquake of this magnitude. For the free-field, the horizontal spectra peaked at about 12 Hz and the vertical spectrum peaked at about 20 Hz. For the Unit 1 containment base, the peaks are shifted to slightly lower frequencies. This shift to lower frequencies is an expected effect of the large foundation.

Conclusions

The occurrence, location, and magnitude of the October 18, 2003, Deer Canyon earthquakes is not a surprise as the sequence of earthquakes is consistent with our understanding of the tectonic framework in the region around DCPP. The events occurred in the San Luis/Pismo block, which is a region of previous seismicity. Additional small earthquakes are expected to occur within this block. The ground motions from the second event (0039 PDT) are typical for ground motions from a magnitude 3.4 earthquake at a distance of 5.0 km.

A detailed report of the Deer Canyon earthquakes, prepared by Dr. Norman Abrahamson and Ms. Marcia McLaren, PG&E Geosciences Department, is available upon request.

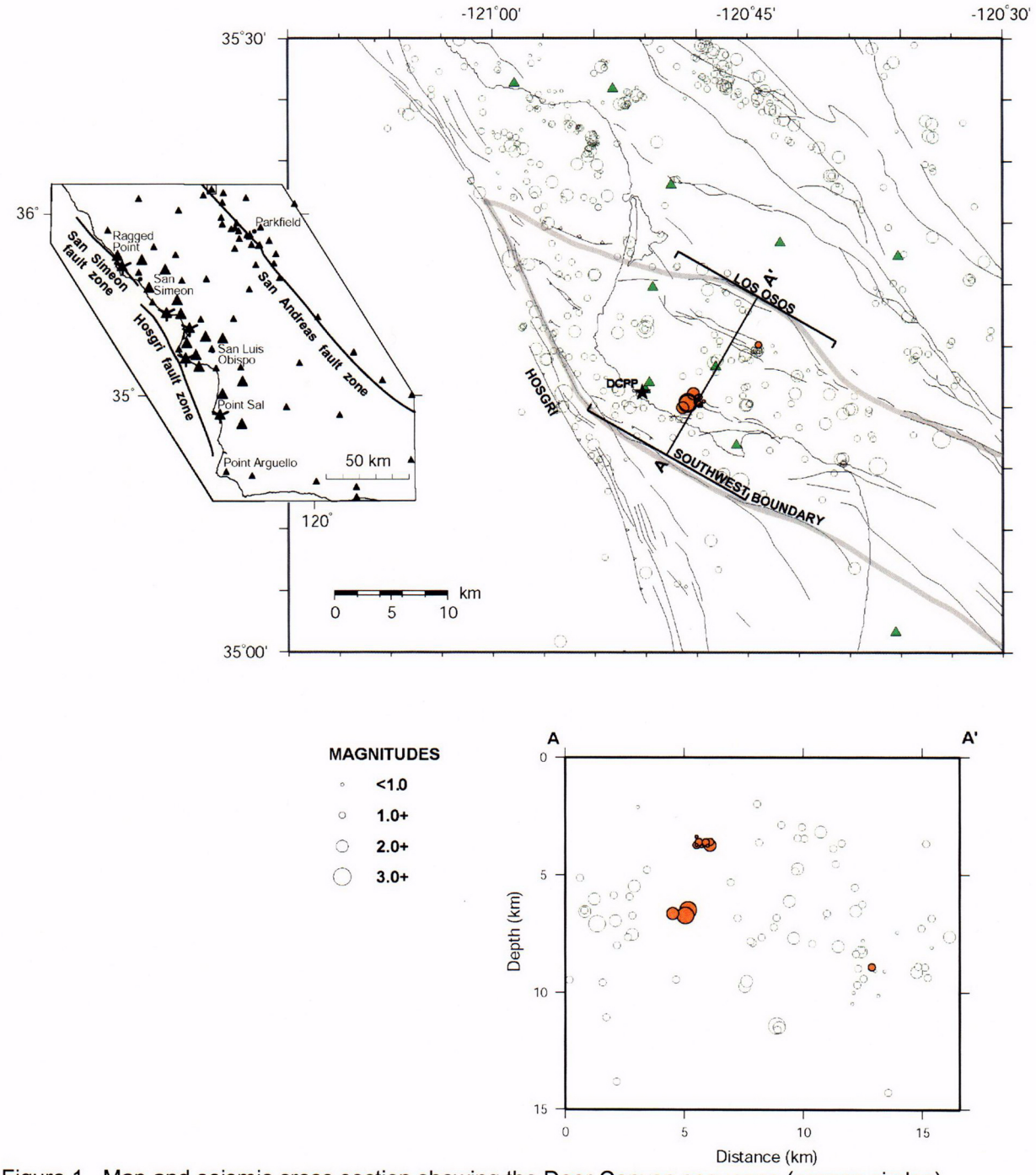

Figure 1. Map and seismic cross section showing the Deer Canyon sequence (orange circles) from October 12 through October 24, 2003, with previous earthquakes (grayed circles) from October 1987 to October 11, 2003. The data were recorded by the PG&E Central Coast Seismic network (large triangles on top figure inset; triangles with tick marks are 3-component stations) and the Northern California Seismic network (small triangles on top figure inset). Seismic stations also are shown on larger map (green triangles). Location of seismic cross section AA' is shown on map with 8-km-wide bars to mark events projected on to the cross section in bottom figure. Quaternary faults are from PG&E (1988); selected faults are labeled. The thick gray line is the boundary of the San Luis/Pismo structural block (Lettis and others, 2001).

C01

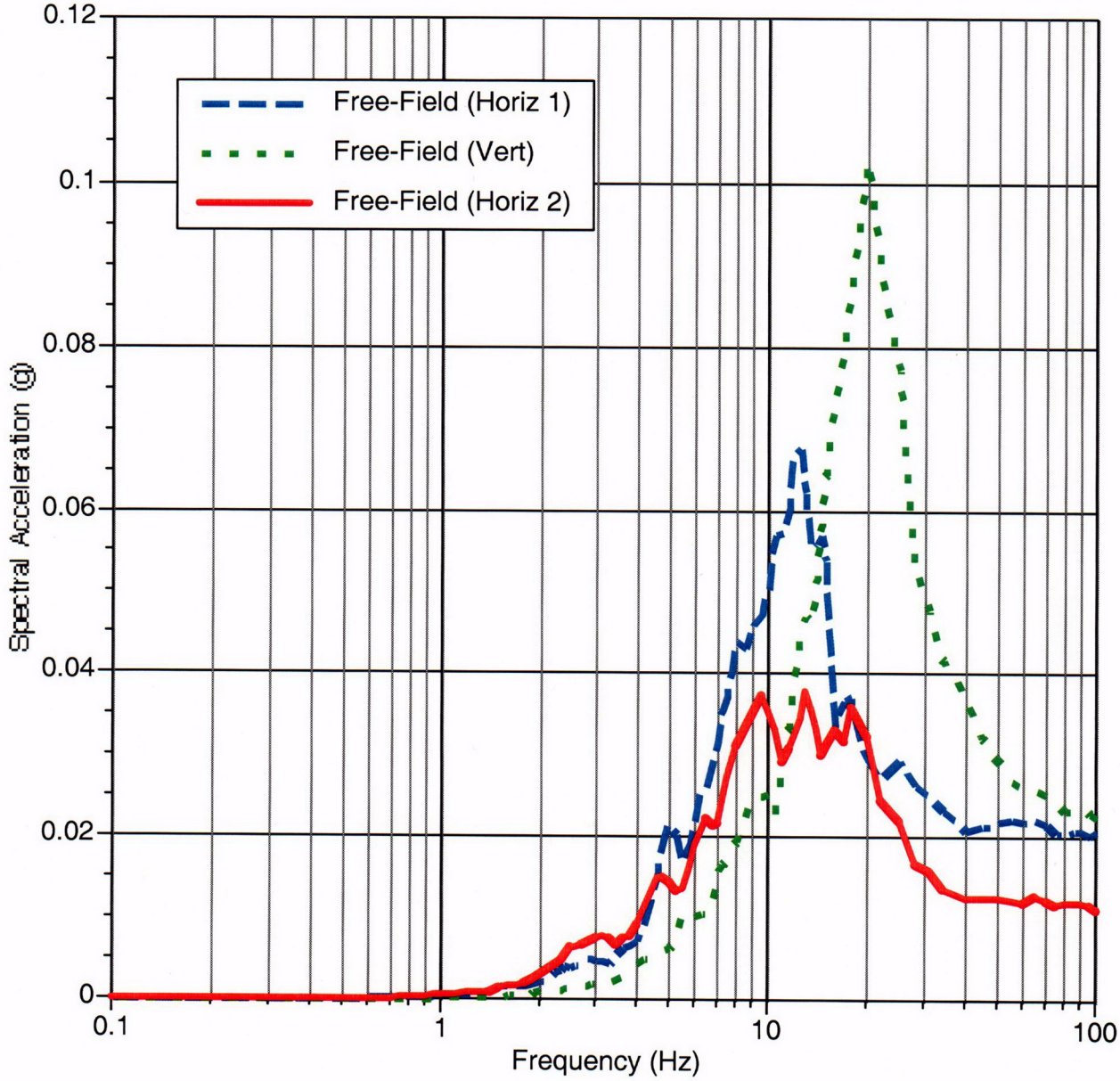

Figure 2. Response spectra at 5% damping for the free-field ground motion.

C02

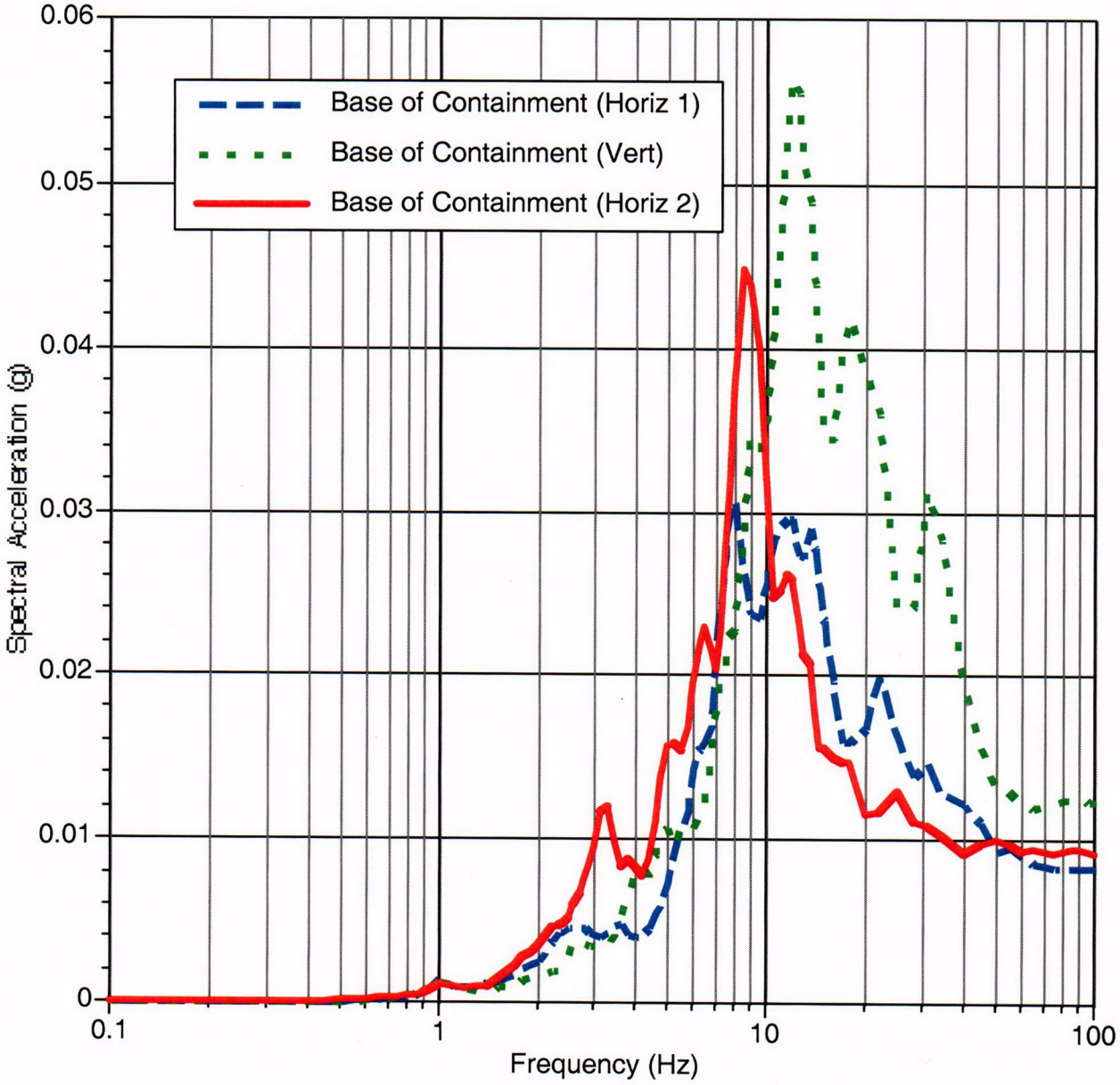

Figure 3. Response spectra at 5% damping for the Unit 1 containment base ground motion.

C03

Table 1: Earthquake location parameters for the Deer Canyon sequence, October 12 to 24, 2003.
Felt events are highlighted in gray.

No.	Date	Time (UTC)	Lat	Lon	Depth	No. P- & S-wave readings	Gap btwn stas. (deg)	Dist. to nearest station (km)	RMS (sec)	*M_D	No. S-wave readings	Horiz. Error (km)	Vert. Error (km)	No. P-wave first motions
1	10/12/2003	13:32 28.54	35 11.97	-120 48.83	6.6	52	145	3	0.13	2.3	2	0.41	0.39	43
2	10/12/2003	16:57 37.60	35 12.28	-120 47.59	3.8	6	137	3	0.07	0.5	1	0.66	0.33	5
3	10/17/2003	13:19 14.33	35 12.49	-120 47.88	3.6	34	123	3	0.14	1.7	4	0.37	0.17	30
4	10/18/2003	07:27 18.37	35 12.23	-120 48.53	6.5	57	125	3	0.12	3.4	2	0.23	0.39	101
5	10/18/2003	07:38 59.14	35 12.15	-120 48.52	6.7	60	127	3	0.12	3.3	2	0.25	0.35	112
6	10/18/2003	07:40 49.52	35 12.10	-120 47.81	3.7	6	149	4	0.05	0.4	1	3.09	1.79	5
7	10/18/2003	07:41 43:44	35 12.18	-120 47.92	3.7	9	147	4	0.09	1.1	1	0.85	0.44	8
8	10/18/2003	07:55 18.96	35 12.13	-120 47.88	3.7	16	132	4	0.12	1.3	3	0.52	0.21	11
9	10/20/2003	10:38 21.93	35 12.24	-120 47.97	3.6	9	146	4	0.07	1.1	1	0.61	0.31	7
10	10/20/2003	18:22 37.72	35 12.35	-120 48.05	3.8	9	142	3	0.07	0.9	1	0.67	0.33	8
11	10/20/2003	19:28 31.85	35 15.05	-120 44.37	8.9	46	50	4	0.10	1.5	3	0.43	0.61	15
12	10/21/2003	08:35 40.18	35 12.43	-120 48.00	3.6	24	125	3	0.11	1.2	2	0.54	0.25	12
13	10/21/2003	13:43 36.44	35 12.65	-120 48.20	3.7	37	119	3	0.12	2.6	3	0.36	0.17	41
14	10/24/2003	23:30 52.84	35 12.06	-120 47.73	3.4	6	147	4	0.07	0.7	0	0.52	0.33	6

*M_D = duration magnitude

Table 2. Peak ground motions values from the Basic Seismic System digital recorders
(after filtering and baseline correction)

Instrument type	Instrument location	Component	Peak Acceleration (g)	Peak Velocity (cm/s)	Peak Displacement (cm)
Kinemetrics SSA	Free field pit (near fitness trailer)	Horizontal 1 (Channel 1)	0.020	0.32	0.0100
		Vertical (Channel 2)	0.022	0.19	0.0042
		Horizontal 2 (Channel 3)	0.011	0.19	0.0068
Kinemetrics SSA	Unit 1 Containment base, 89' elev.	Horizontal 1 (Channel 1)	0.008	0.16	0.0077
		Vertical (Channel 2)	0.012	0.16	0.0060
		Horizontal 2 (Channel 3)	0.009	0.22	0.0094

Analysis of The Resultant Effect Upon Facility Features Important To Safety For The Seismic Event of October 18, 2003

Plant Systems Response:

Per Casualty Procedure (CP) M-4, "Earthquake," a walkdown of the facility was conducted. All systems continued to operate normally, no fires were discovered. No visible damage was discovered. No alarms were received in the control room for the first seismic event; alarms received in the control room for the second seismic event are as follows:

U-1 Alarms

- Accumulator 1-3 level high; the accumulator level was high in the normal operating band (71-72 percent). The alarm came in and out several times, and returned to normal.
- Turbine supervisory instrument drawer. Bearing 5 came into alarm and returned to normal.

U-2 Alarms

- Turbine supervisory instrument drawer. Bearing 5 came into alarm and returned to normal.

Seismic Monitoring Instrumentation Response:

Two seismic events were felt on the plant site this date. The first event was felt at approximately 0027 with the second one at 0039. CP M-4 was entered after the second event. The first event was felt but did not show any increase on the seismic monitors. The second event showed approximately 0.02g on the vertical indication of earthquake force monitor indicator, EFM-1. During the seismic event, the Unit 1 containment base appeared to have experienced ground motion about 0.02g based on initial indications; however, the Kinemetrics trigger for the control room alarm did not actuate. The nominal trigger setpoint for the Kinemetrics trigger is 0.01 g, +/- 0.002g. The maximum acceleration at the containment base, after analysis, was determined to be 0.012g.

The Kinemetrics trigger instrument calibration was performed by the instrument vendor following this event. The as found data were within specification. In addition, the Kinemetrics trigger switch was found to be within its instrument tolerance and thus operated as designed for this low level event.

Therefore, the response by the Kinemetrics system and trigger were proper for this low level event, and were considered operable based on vendor-provided calibration data and resulting engineering evaluation.