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## PACIFIC GAS AND ELECTRIC COMPANY

PG&amp;E

77 BEALE STREET • SAN FRANCISCO, CALIFORNIA 94105 • (415) 781-4211 • TWX 910-372-6587

J. O. SCHUYLER  
VICE PRESIDENT  
NUCLEAR POWER GENERATION

February 16, 1984

PGandE Letter No: DCL-84-059

J. Knight

J. Fair (IR)

Mr. John B. Martin, Regional Administrator  
U.S. Nuclear Regulatory Commission, Region V  
1450 Maria Lane, Suite 210  
Walnut Creek, CA 94596-5368

Re: Docket No. 50-275, OL-DPR-76  
Diablo Canyon Unit 1  
SECY-84-61 - Items 25, 58, 96, 142, 154, and 176  
Concrete Expansion Anchors

Dear Mr. Martin:

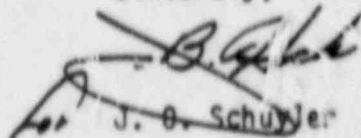
Information on the use of concrete expansion anchors at Diablo Canyon was summarized in PGandE letter DCL-84-031 dated January 27, 1984. In a subsequent letter, DCL-84-048 dated February 7, 1984, PGandE stated that a successful sampling program for as-built conditions of the expansion anchors would enhance confidence in conclusions discussed in the January 27, 1984 letter. The anchor bolt sampling program described in the February 7 letter and evaluation of the data have been completed. This submittal provides the results of the sampling program.

In the February 7 letter, PGandE committed to review the electrical contractor's inspection records to identify cases of anchor bolt straightening and torquing to improve nut engagement. The results of this review are also included in this submittal.

Completion of the anchor bolt sampling program and contractor records review confirms PGandE's earlier conclusion regarding the adequacy of concrete anchor bolts.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

  
J. O. Schuyler

Enclosures

cc: D. G. Eisenhut  
H. E. Schierling

0506040580 841118  
PDR FOIA  
DEVINE84-744 PDR

ENCLOSURE

Concrete Expansion Anchors in Electrical Raceway Supports

Information on the use of concrete expansion anchors at the Diablo Canyon Power Plant (Diablo Canyon) was summarized in PGandE letter DCL-84-031 dated January 27, 1984. This summary contained the results of a review of inspection records, onsite tests, design calculations, and other published data which supported the conclusion that expansion anchor usage at Diablo Canyon is fully acceptable. Subsequently, the NRC Staff and PGandE agreed that sampling the as-built conditions of the expansion anchors would enhance the confidence in the conclusions reached in the January 27 letter. This submittal provides the results of the sampling program.

In another submittal (PGandE letter DCL-84-048 dated February 7, 1984), PGandE provided the NRC Staff with a copy of the instructions that were used to perform the expansion anchor sampling. In that February 7 letter, PGandE additionally committed to review the electrical contractor's inspection records to identify cases of anchor bolt straightening and torquing to improve nut engagement. The results of this review are also included in this submittal.

The objective of the sampling program was to confirm the adequacy of expansion anchor installation in electrical raceway supports on a statistical basis. For the purpose of this program, adequate installation of an individual support is achieved when the expansion anchors included in the support calculations have a safety factor of at least 3 relative to their capacity. The overall adequacy of the expansion anchors in the raceway supports is statistically confirmed when a random sampling program achieves a 95% confidence level that 95% of the supports meet the above definition of adequacy.

The expansion anchor sampling program just completed at Diablo Canyon included 98 randomly selected electrical raceway supports. For each of these supports, safety factors have been confirmed to be greater than 3, even after reducing individual anchor capacities for concerns such as embedment, spacing, and edge distance. Thus, confidence in the adequacy of the raceway supports using expansion anchors exceeds the 95 percent level.

One of the concerns involved the embedment of the 2-3/4" long Hilti Kwik-Bolt expansion anchors. The shorter overall length of these anchors raised a question as to whether the embedment was sufficient to maintain adequate safety factors. In the primary sample (the 98 randomly selected supports), 10 supports contained the 2-3/4" long anchors. When a 2-3/4" long anchor was encountered, the sampling instructions required adjacent supports along the conduit run to be added to the sample. This resulted in investigation of 22 additional supports. Six of these 22 adjacent supports also contained 2-3/4"

long anchors. Subsequent evaluation of the anchors in all 16 affected supports confirmed that factors of safety in excess of 3 existed in every case. These results corroborate the January 27 conclusions regarding the adequacy of supports containing these shorter anchors.

The following attachments provide details on the selection of supports to be sampled (Attachment A); a summary of the data that was compiled (Attachment B); a discussion on the statistical evaluation of the data (Attachment C); a discussion on how factors of safety were calculated (Attachment D); and a discussion on the significance of the installation deviations found in the sampling program, as well as those recorded in the electrical contractor's inspection records (Attachment E).

In summary, the expansion anchor sampling program has confirmed on a statistical basis, that expansion anchor installation at Diablo Canyon is reasonable, conservative, and acceptable.

#### Attachment A - Selection of Sampled Supports

The Diablo Canyon electrical raceways contain approximately 23,000 supports. The expansion anchor sample set was selected from these supports by numbering each support sequentially and generating a set of random numbers. The supports corresponding to these random numbers comprised the sample set. A total of approximately 100 supports was intended to be sampled. This sample size is consistent with the statistical evaluation that was desired. See Attachment C for further information on the statistical evaluation.

As detailed below, some raceway supports could not be used as samples, so it was necessary to review more than 100 supports to obtain the required sample size. A total of 401 randomly selected raceway supports were investigated before the desired sample size was achieved.

Exclusion of a randomly selected support from the sample set occurred for one of the following reasons:

1. Some supports did not contain expansion anchors. These consisted of supports welded to steel members or attached to embedded Unistrut channels with structural bolts. Of the 401 supports investigated, 112 were of this type.
2. Other supports were found to be inaccessible. Inaccessible supports were those that would have required extensive scaffolding to reach, those located in areas of rooms where other work was in progress, and those located behind other plant components such that the measurement equipment could not be readily used. There were 124 supports of this type.
3. In some highly congested areas, identification of a specific support proved difficult. Supports that could not be fully identified within a reasonable time (generally 1/2 hour) were excluded from the sample set. Twenty-nine supports could not be readily identified. In addition, a single page of the list of random support numbers was inadvertently lost in transmittal to the site. Sampling of the other supports on the list continued and an adequate sample size (98) was reached before this was discovered and the page retransmitted. As a result, 37 supports listed on that page were omitted from the sample.

As previously noted, 22 supports were added in the sample set to provide additional data for evaluating 2-3/4" long Hilti Kwik-Bolts. These 22 additional samples consisted of supports located directly adjacent to the randomly selected supports that were found to contain the 2-3/4" long anchors.

Thus, for the sample program, complete data was compiled on 120 electrical raceway supports. Attachment B contains a summary of the data recorded for each support sampled.



## Attachment B - Summary of Data

The following tables contain the data compiled in the expansion anchor sampling program.

Table B-1 provides an overall summary of sampling program findings.

Table B-2 provides a summary of findings by specific concern.

Table B-3 contains the data on each support investigated. Except when otherwise noted, the numbers in this table represent the quantity of anchors with the concern identified by the column heading. Factors of safety are listed for supports containing one or more anchors with concerns. For all other supports, specific factors of safety have not been calculated, but are always greater than 3 based on previous generic calculations.

Attachment B

Table B-1 - Summary of Sample Findings

	Random Samples			Adjacent Samples		
	Pre-1975	Post-1975	Total	Pre-1975	Post-1975	Total
No. of supports containing anchors with no concerns	25	39	64	12	1	13
No. of supports containing one or more anchors with specific concerns	22	12	34	8	1	9
Total	47	51	98	20	2	22

Attachment B

Table B-2 - Summary Listing of Concerns<sup>(1)</sup>

	Random Samples			Adjacent Samples		
	Pre-1975	Post 1975	Total	Pre-1975	Post 1975	Total
2-3/4" long Hilti Kwik-Bolts	9	1(2)	10	6	0	6
Embedment less than minimum per Dwg. 054162	12	2	14	6	1	7
Angle between 50° - 150°	5	6	11	1	0	1
Angle greater than 150°	0	0	0	1	0	1
Spacing less than 10 diameters	12	5	17	1	0	1
Edge distance less than 5 diameters	2	0	2	0	0	0
Nut engagement less than flush	1	0	1	1	0	1
Nuts not tight	4	0	4	0	0	0

NOTES:

- (1) The numbers in the table represent the quantity of supports containing one or more anchors with the concerns listed.
- (2) This support was probably installed before 1975 (cable was pulled on 10/75)

Table B-3 - Individual Support Data

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
1	-										no exp. anchors
2	-										not identified
3	-										no exp. anchors
4	-										inaccessible
5	-										not identified
6	-										no exp. anchors
7	5/75	4	-	-	(F)	-	-	1 loose	1	1	OK, F of 9.3.3
8	9/79	2	-	-	(F)	-	-	1 loose	2	2	OK
9	12/74	2	-	-	-	-	-	-	3	3	OK, F of 5 > 10
10	8/79	2	-	-	-	-	-	-	4	4	OK
11	-										no exp. anchors
12	12/74	8	4	5	2084 (F) 1294 (F)	-	-	-	5	3	OK, F of 9.5.0
• 12A	• 12/74	• 3	• -	• -	• - (F)	-	-	• -			• OK
13	-										no exp. anchors
14	-										inaccessible
15	-										no exp. anchors
16	3/75	2	-	-	-	-	-	-	6	4	OK
17	-										no exp. anchors
18	-										not identified
19	-										no exp. anchors
20	-										abandoned support
21	5/74	2	-	-	-	-	-	-	7	5	OK
22	-										inaccessible
23	-										no exp. anchors
24	-										no exp. anchors
25	-										inaccessible
26	-										no exp. anchors
27	-										no exp. anchors
28	-										no exp. anchors



Table B-3

Sample No.	Date Installed	No. of Anchors	Short Embedment	Spacing	Edge Dist.	Nut Eng'm't	Tight	Overall Seq. No.	Pre-75 Seq. No.	Eval. Results/Remarks
29	-									inaccessible
30	-									no exp. anchors
31	-									not identified
32	11/78	2	-	(F)	-	-	-	8		OK
33	-									no exp. anchors
34	2/75	4	-	(F)	-	-	-	9	6	OK
35	-									no exp. anchors
36	-									inaccessible
37	-									inaccessible
38	-									no exp. anchors
39	-									inaccessible
40	-									not identified
41	-									no exp. anchors
42	-									not identified
43	-									inaccessible
44	-									not identified
45	-									inaccessible
46	-									no exp. anchors
47	-									no exp. anchors
48	-									inaccessible
49	-									no exp. anchors
50	-									inaccessible
51	-									no exp. anchors
52	3/75	2	-	-	-	-	-	10	7	OK
53	9/78	2	-	-	-	-	-	11		OK
54	-									no exp. anchors
55	-									no exp. anchors
56	8/78	2	-	(F)	-	-	-	12		OK
57	-									no exp. anchors

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Embedment	X	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
58	-	-	-	-	-	-	-	-	-	-	inaccessible
59	-	-	-	-	-	-	-	-	-	-	inaccessible
60	-	-	-	-	-	-	-	-	-	-	no exp. anchors
61	-	-	-	-	-	-	-	-	-	-	no exp. anchors
62	-	-	-	-	-	-	-	-	-	-	not identified
63	-	-	-	-	-	-	-	-	-	-	no exp. anchors
64	-	-	-	-	-	-	-	-	-	-	no exp. anchors
65	2/75	4	-	105/10	(F)	-	-	-	13	8	OK, F of S > 10
66	-	-	-	-	-	-	-	-	-	-	not identified
67	-	-	-	-	-	-	-	-	-	-	inaccessible
68	-	-	-	-	-	-	-	-	-	-	no exp. anchors
69	-	-	-	-	-	-	-	-	-	-	no exp. anchors
70	4/75	2	-	-	-	-	-	-	14	9	OK
71	12/74	2	-	-	(F)	-	-	-	15	10	OK
72	6/81	2	-	-	-	-	-	-	16	-	OK
73	-	-	-	-	-	-	-	-	-	-	inaccessible
74	-	-	-	-	-	-	-	-	-	-	no exp. anchors
75	-	-	-	-	-	-	-	-	-	-	inaccessible
76	-	-	-	-	-	-	-	-	-	-	inaccessible
77	-	-	-	-	-	-	-	-	-	-	not identified
78	-	-	-	-	-	-	-	-	-	-	inaccessible
79	-	-	-	-	-	-	-	-	-	-	inaccessible
80	-	-	-	-	-	-	-	-	-	-	inaccessible
81	-	-	-	-	-	-	-	-	-	-	no exp. anchors
82	-	-	-	-	-	-	-	-	-	-	inaccessible
83	-	-	-	-	-	-	-	-	-	-	no exp. anchors
84	-	-	-	-	-	-	-	-	-	-	no exp. anchors
85	-	-	-	-	-	-	-	-	-	-	inaccessible
86	-	-	-	-	-	-	-	-	-	-	inaccessible

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Eng'm't	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
87	-											
88	12/75	4	-	-	-	(F)	-	-	-	17		no exp. anchors OK
89	-											inaccessible
90	4/75	2	-	-	-	-	-	-	-	18	11	OK
91	10/75	8	1	1	-	(F)	-	-	-	19		OK, F of S > 10
• 91A	• 10/75	• 2	• -	• 1	• -	• (F)	• -	• -	• -			• OK, F of S > 10
• 91B	• 10/75	• 2	• -	• -	• -	• -	• -	• -	• -			• OK
92	-											no exp. anchor
93	-											inaccessible
94	-											inaccessible
95	-											no exp. anchors
96	-											no exp. anchors
97	-											no exp. anchors
98	-											no exp. anchors
99	-											no exp. anchors
100	-											inaccessible
101	-											not identified
102	-											no exp. anchors
103	3/80	4	-	-	-	1@6d	-	-	-	20		OK, F of S > 10
104	-											field data incomplete
105	-											anchor inaccessible
106	-											no exp. anchors
107	-											no exp. anchors
108	-											inaccessible
109	3/75	4	2	2	-	(F)	-	-	-	21	12	no exp. anchors OK, F of S > 10
• 109A	• 3/75	• 4	• 4	• 4	• -	• (F)	• -	• -	• -			• OK, F of S > 10
• 109B	• 3/75	• 4	• 4	• 4	• -	• (F)	• -	• -	• -			• OK, F of S > 10
• 109C	• 3/75	• 4	• -	• -	• -	• (F)	• -	• -	• -			• OK
110	-											not identified



Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
111	12/74	4	-	-	105°/15°	109d (F)	-	-	-	22	13	OK, F of S > 10 inaccessible
112	-	-	-	-	-	(F)	-	-	-	23	14	OK
113	9/75	4	-	-	-	(F)	-	-	-	-	-	no exp. anchors
114	-	-	-	-	-	(F)	-	-	-	24	15	OK
115	11/74	6	-	-	-	-	-	-	-	-	-	not identified
116	-	-	-	-	-	-	-	-	-	-	-	inaccessible
117	-	-	-	-	105°/15°	(F)	2@4.5d	-	-	25	16	OK, F of S = 8.2, one OK, nut deformed
118	10/74	4	2	2	•	(F)	•	•	•	-	-	• OK
• 118A	• 10/74	• 4	•	•	•	•	•	•	•	-	-	inaccessible
119	-	-	-	-	-	-	-	-	-	-	-	no exp. anchor
120	-	-	-	-	-	-	-	-	-	-	-	inaccessible
121	-	-	-	-	-	-	-	-	-	-	-	no exp. anchors
122	-	-	-	-	-	-	-	-	-	-	-	no exp. anchors
123	-	-	-	-	-	-	-	-	-	-	-	inaccessible
124	-	-	-	-	-	-	-	-	-	-	-	inaccessible
125	-	-	-	-	-	-	-	-	-	26	-	OK
126	4/80	2	-	-	-	-	-	-	-	-	-	not identified
127	-	-	-	-	-	-	-	-	-	-	-	no exp. anchor
128	-	-	-	-	-	-	-	-	-	-	-	inaccessible
129	-	-	-	-	-	-	-	-	-	-	-	inaccessible
130	-	-	-	-	-	-	-	-	-	-	-	no exp. anchors
131	-	-	-	-	-	-	-	-	-	-	-	no exp. anchors field data incomplete
132	-	-	-	-	-	-	-	-	-	-	-	anchors inaccessible
133	-	-	-	-	-	-	-	-	-	-	-	no exp. anchors
134	-	-	-	-	-	-	-	-	-	-	-	inaccessible
135	-	-	-	-	-	-	-	-	-	-	-	inaccessible
136	-	-	-	-	-	-	-	-	-	-	-	inaccessible
137	-	-	-	-	-	-	-	-	-	-	-	not identified
138	-	-	-	-	-	-	-	-	-	-	-	not identified



Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
139	-											not identified
140	-											inaccessible
141	-											not identified
142	-									27		no exp. anchors
143	8/78	3	-	-	-	-	-	-	-			OK
144	-											no exp. anchors
145	-											no exp. anchors
146	-											no exp. anchors
147	-											inaccessible
148	10/75	2	-	-	-	(F)	-	-	-	28		OK
149	-											no exp. anchors
150	-											not identified
151	11/78	2	-	-	-	-	-	-	-	29		OK
152	-											no exp. anchors
153	-											inaccessible
154	-											inaccessible
155	-											inaccessible
156	-											not identified
157	7/77	2	-	-	-	(F)	-	-	-	30		OK
158	5/74	2	-	-	-	(F)	-	-	-	31	17	OK
159	5/74	4	-	-	-	1@3d, (F)	-	-	-	32	18	OK, FafS > 10
160	-											no exp. anchors
161	-											not identified
162	12/74	2	-	-	-	1@7d	-	-	-	33	19	OK, FafS > 10
163	7/75	1	-	-	-	-	-	-	-	34	20	OK
164	-											no exp. anchors
165	11/76	4	-	-	-	(F)	-	-	-	35		OK
166	4/80	2	-	-	-	-	-	-	-	36		OK
167	1/75	4	-	-	-	(F)	-	-	-	37	21	OK

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-75 Seq. No.	Eval. Results/Remarks
168	12/74	4	-	-	-	(F)	-	-	-	38	22	OK
169	-											no exp. anchors
170	-											no exp. anchors
171	-											no exp. anchors
172	-											no exp. anchors
173	5/78	10	-	8	-	30Bd 409d (F)	-	-	-	39		OK, F of S = 7.2
174	4/75	2	-	-	-	(F)	-	-	-	40	23	OK
175	-											inaccessible
176	10/80	2	-	-	2@5°/15°	(F)	-	-	-	41		OK, F of S = 5.4
177	2/74	2	-	-	-	(F)	-	-	-	42	24	OK
178	7/80	3	-	-	-	(F)	-	-	-	43		OK
179	-											not identified
180	5/74	2	-	-	-	(F)	-	-	-	44	25	OK
181	-											no exp. anchors
182	9/78	2	-	-	-	-	-	-	-	45		OK
183	-											inaccessible
184	-											not identified
185	-											inaccessible
186	-											no exp. anchors
187	6/75	8	7	7	1@5°/15°	109d (F)	-	-	-	46	26	OK, F of S = 5.4
•187A	•6/75	•4	•1	•1	•-	•-	•-	•1@1thd.	•-			•OK, F of S > 10
•187B	•6/75	•2	•1	•1	•-	•(F)	•-	•-	•-			•OK F of S > 10, one bolt cut flush w/nut
•187C	•6/75	•2	•1	•1	•-	•(F)	•-	•-	•-			•OK, F of S > 10
188	-											inaccessible
189	-											field data incomplete - anchor inaccessible
190	-											no exp. anchors
191	-											no exp. anchors
192	5/81	3	-	-	-	(F)	-	-	-	47		OK
193	7/81	2	-	-	-	(F)	-	-	-	48		OK

Table B-3

Sample No.	Date Installed	No. of Anchors	Short Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
194	-	-	-	-	-	-	-	-	-	-	inaccessible
195	-	-	-	-	-	-	-	-	-	-	inaccessible
196	-	-	-	-	-	-	-	-	-	-	no exp anchors
197	6/74	2	-	-	(F)	-	-	-	49	27	OK
198	-	-	-	-	-	-	-	-	-	-	inaccessible
199	-	-	-	-	-	-	-	-	-	-	inaccessible
200	-	-	-	-	-	-	-	-	-	-	inaccessible
201	-	-	-	-	-	-	-	-	-	-	-
202	-	-	-	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	-	-	-
209	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	-	-	-
211	-	-	-	-	-	-	-	-	-	-	-
212	-	-	-	-	-	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-
214	-	-	-	-	-	-	-	-	-	-	-
215	-	-	-	-	-	-	-	-	-	-	-
216	-	-	-	-	-	-	-	-	-	-	-
217	-	-	-	-	-	-	-	-	-	-	-
218	-	-	-	-	-	-	-	-	-	-	-
219	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-	-	-
222	-	-	-	-	-	-	-	-	-	-	-

These samples were inadvertently skipped when their associated support numbers were temporarily lost in transmittal to the jobsite.



Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Embedment	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
223	-	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	-	-	-
225	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	-	-	-	-	-
227	-	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	-	-
231	-	-	-	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-	-	-
234	-	-	-	-	-	-	-	-	-	-
235	-	-	-	-	-	-	-	-	-	-
236	-	-	-	-	-	-	-	-	-	-
237	-	-	-	-	-	-	-	-	-	-
238	10/82	2	-	-	-	-	-	50	-	OK
239	-	-	-	-	-	-	-	-	-	inaccessible
240	-	-	-	-	-	-	-	-	-	no exp. anchors
241	-	-	-	-	-	-	-	-	-	no exp. anchors
242	7/75	2	-	-	-	-	-	51	28	OK
243	-	-	-	-	-	-	-	-	-	no exp. anchors
244	-	-	-	-	-	-	-	-	-	inaccessible
245	3/77	2	-	105/10	-	-	-	52	-	OK F of S > 10
246	10/74	4	1	105/10	103d	-	-	53	29	OK, F of S > 10
• 246A • 10/74	-	3	•	•	•	•	•	-	-	• OK
247	-	-	-	-	-	-	-	-	-	no exp. anchors
248	-	-	-	-	-	-	-	-	-	inaccessible
249	-	-	-	-	-	-	-	-	-	inaccessible
250	-	-	-	-	-	-	-	-	-	no exp. anchors

These samples were inadvertently skipped when their associated support numbers were temporarily lost in transit to the jobsite.

inaccessible  
no exp. anchors  
no exp. anchors  
OK  
no exp. anchors  
inaccessible  
OK F of S > 10  
OK, F of S > 10  
• OK  
no exp. anchors  
inaccessible  
inaccessible  
no exp. anchors



Table B-3

Sample No.	Date Installed	No. of Anchors	Short Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
251	-	-	-	-	-	-	-	-	-	-	no exp. anchors
252	-	-	-	-	-	-	-	-	-	-	inaccessible
253	8/80	3	-	1@5/10°	(F)	-	-	-	54	-	<del>inaccessible</del>
254	10/75	8	-	-	1@6d (F)	-	-	-	55	-	OK, F of S > 10
255	-	-	-	-	-	-	-	-	-	-	this sample no. not identified, skipped
256	-	-	-	-	-	-	-	-	-	-	inaccessible
257	4/79	2	-	-	(F)	-	-	-	56	-	OK
258	-	-	-	-	-	-	-	-	-	-	no exp. anchors
259	-	-	-	-	-	-	-	-	-	-	no exp. anchors
260	-	-	-	-	-	-	-	-	-	-	inaccessible
261	6/74	4	-	-	(F)	-	-	-	57	30	OK
262	-	-	-	-	-	-	-	-	-	-	no exp. anchors
263	-	-	-	-	-	-	-	-	-	-	inaccessible
264	-	-	-	-	-	-	-	-	-	-	no exp. anchors
265	-	-	-	-	-	-	-	-	-	-	inaccessible
266	-	-	-	-	-	-	-	-	-	-	inaccessible
267	6/74	8	-	-	(F)	-	-	-	58	31	OK
268	-	-	-	-	-	-	-	-	-	-	inaccessible
269	-	-	-	-	-	-	-	-	-	-	inaccessible
270	-	-	-	-	-	-	-	-	-	-	inaccessible
271	2/83	2	-	-	(F)	-	-	-	59	-	OK
272	-	-	-	-	-	-	-	-	-	-	inaccessible
273	3/75	4	-	-	(F)	-	-	-	60	32	OK
274	-	-	-	-	-	-	-	-	-	-	inaccessible
275	-	-	-	-	-	-	-	-	-	-	not identified
276	-	-	-	-	-	-	-	-	-	-	not identified
277	-	-	-	-	-	-	-	-	-	-	inaccessible
278	8/74	2	1	-	-	-	-	-	61	33	OK, F of S > 10
• 278A	• 8/74	• 1	• -	• -	• -	• -	• -	• -	-	-	• OK

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Eng'm't	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
279	-											inaccessible
280	-											no exp. anchors
281	-											inaccessible
282	-											no exp. anchors
283	-											no exp. anchors
284	-											not identified
285	-											inaccessible
286	-											no exp. anchors
287	-											inaccessible
288	4/80	2	-	-	-	(F)	-	-	-	62		OK
289	-											no exp. anchors
290	-											inaccessible
291	-											inaccessible
292	-											no exp. anchors
293	-											inaccessible
294	4/81	2	-	-	-	(F)	-	-	-	63		OK
295	-											no exp. anchors
296	-											no exp. anchors
297	11/80	2	-	-	-	(F)	-	-	-	64		OK
298	-											inaccessible
299	10/75	4	-	-	-	(F)	-	-	-	65		OK
300	6/74	4	2	2	-	10.65d (F)	-	-	-	66	34	OK, F of S > 10
• 300A	• 6/74	• 4	• 1	• 1	• -	• (F)	• -	• -	• -			• OK, F of S > 10
• 300B	• 6/74	• 4	• -	• -	• 205/15	• 204d (F)	• -	• -	• -			• OK, F of S > 10
301	10/80	2	-	-	-	-	-	-	-	67		OK
302	-											inaccessible
303	12/74	4	4	4	-	10.85d (F)	-	-	-	68	35	OK, F of S > 10
• 303A	• 12/74	• 2	• -	• 1	• 205/15	• (F)	• -	• -	• -			• OK, F of S > 10
• 303B	• 12/74	• 4	• -	• -	• -	• (F)	• -	• -	• -			• OK

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
304	-											no exp. anchors
305	-											inaccessible
306	-											inaccessible
307	-											no exp. anchors
308	6/74	2	-	2	-	(F)	-	-	-	69	36	ok, F of S > 10
309	-											inaccessible
310	-											no exp. anchors
311	-											inaccessible
312	-											inaccessible
313	-											inaccessible
314	-											no exp. anchors
315	-											no exp. anchors
316	7/74	8	1	2	-	30.5d (F)	-	-	-	70	37	ok, F of S = 5.2
• 316A	• 7/74	• 7	• -	• -	• -	• -	• -	• -	• -			• OK
317	12/74	2	-	-	-	-	-	-	-	71	38	OK
• 317A	• 12/74	• 4	• -	• -	• -	• (F)	• -	• -	• -			• OK
318	-											inaccessible
319	-											no exp. anchors
320	5/75	2	-	1	-	-	-	-	1 loose	72	39	OK, F of S > 10
• 320A	• 5/75	• 2	• -	• -	• -	• -	• -	• -	• -			• OK
321	-											inaccessible
322	-											inaccessible
323	-											no exp. anchors
324	8/79	2	-	-	-	-	-	-	-	73		OK
325	-											inaccessible
326	9/82	2	-	-	-	-	-	-	-	74		OK
327	-											Inaccessible
328	-											not identified
329	5/83	2	-	-	-	10.9d (F)	-	-	-	75		OK, F of S > 10



Table B-3

Sample No.	Date Installed	No. of Anchors	Short Anchors	Embedment	$\Delta$	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
330	-											not identified
331	-											inaccessible
332	-											no exp. anchors
333	-											inaccessible
334	-											inaccessible
335	11/75	4	-	-	-	(F)	-	-	-	76		OK
336	-											no exp. anchors
337	9/81	4	-	-	1@5°/10°	(F)	-	-	-	77		OK, F of S = 4.1
338	-											inaccessible
339	9/77	2	-	-	-	(F)	-	-	-	78		OK
340	6/78	4	-	-	2@5°/15°	(F)	-	-	-	79		OK, F of S > 10
341	-											field data incomplete - 1 anchor inaccessible
342	-											no exp. anchors
343	-											inaccessible
344	10/80	2	-	-	-	(F)	-	-	-	80		OK
345	-											inaccessible
346	-											inaccessible
347	8/77	4	-	-	-	2@9d(F)	-	-	-	81		OK, F of S = 20
348	4/74	4	-	-	-	(F)	-	-	-	82	40	OK
349	-											inaccessible
350	4/79	2	-	-	-	(F)	-	-	-	83		OK
351	-											inaccessible
352	-											no exp. anchors
353	3/75	2	-	-	-	-	-	-	-	84	41	OK
354	7/75	9	-	-	-	1@7d(F)	-	-	-	85	42	OK, F of S > 10
355	12/80	3	-	-	-	(F)	-	-	-	86		OK
356	-											inaccessible
357	-											inaccessible



Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
358	-										inaccessible
359	-										inaccessible
360	6/80	2	-	-	-	(F)	-	-	87		OK
361	6/74	8	-	1	-	156.5d 208d (F)	-	-	88	43	OK, F of S > 10
• 361A	• 6/74	• 8	• -	• -	• -	• (F)	• -	• -			• OK
362	-										inaccessible
363	-										no exp. anchors
364	-										inaccessible
365	-										no exp. anchors
366	-										no exp. anchors
367	5/75	2	-	-	-	(F)	-	-	89	44	OK
368	-										no exp. anchors
369	8/80	2	-	-	-	(F)	-	-	90		OK
370	9/78	3	-	-	-	(F)	-	-	91		OK
371	-										inaccessible
372	-										field data incomplete - anchor inaccessible
373	8/80	4	-	-	-	(F)	-	-	92		OK
374	-										inaccessible
375	5/81	3	-	-	-	(F)	-	-	93		OK
376	-										inaccessible
377	-										no exp. anchors
378	3/83	2	-	-	105/15°	(F)	-	-	94		OK, F of S > 10
379	-										no exp. anchors
380	-										inaccessible
381	-										inaccessible
382	-										inaccessible
383	-										not identified
384	-										no exp. anchors

Table B-3

Sample No.	Date Installed	No. Of Anchors	Short Anchors	Embedment	X	Spacing	Edge Dist.	Nut Engmt	Tight	Overall Seq. No.	Pre-'75 Seq. No.	Eval. Results/Remarks
385	-											inaccessible
386	-											no exp. anchors
387	-											no exp. anchors
388	-											inaccessible
389	-											inaccessible
390	-											inaccessible
391	-											no exp. anchors
392	9/74	2	-	-	-	1@9d(F)	-	-	-	95	45	<del>inaccessible</del>
393	-											inaccessible
394	1/75	4	-	1	-	1@9.5d(F)	-	-	-	96	46	OK, F of S > 10
• 394A	• 1/75	• 4	• 2	• 2	• -	• (F)	• -	• -	• -			• OK, F of S > 10
• 394B	• 1/75	• 4	• -	• -	• -	• (F)	• -	• -	• -			• OK
395	-											inaccessible
396	7/74	5	-	-	-	(F)	-	1 w/o nut (F)	1 w/o nut (F)	97	47	OK, F of S > 10, one nut missing
397	4/82	2	-	-	-	(F)	-	-	-	98		OK
398	-											inaccessible
399	-											no exp. anchors
400	-											not identified
401	-											inaccessible

- Notes:
- (1) The date installed is actually the date cable was pulled through the conduit attached to the subject support.
  - (2) The pre-1975 sequence number includes all supports which had cable pulled by July, 1975.
  - (3) (F) indicates that the affected anchor(s) are in a fitting. Spacing concerns were accounted for in the design calculations.
  - (4) • identifies an adjacent support sample (i.e., not one of the primary 98 randomly selected supports).
  - (5) (G) indicates that the factor of safety was obtained from a generic calculation. The actual factor of safety for specific support is likely to be much higher.

### Attachment C - Statistical Discussion

The objective of the sampling program was to select a statistically valid sample from which an appropriate confidence level on the adequacy of raceway support expansion anchor installation could be established. In applying this approach, adequacy of a support is achieved when the expansion anchors included in the support calculations have a safety factor of at least 3 relative to their capacity. (See Attachment D for a discussion on factors of safety.)

It was determined that the sample program would be adequate if it could be demonstrated at a 95% confidence level that 95% of the supports sampled meet the test of adequacy defined above. Based on the statistics described below, this confidence level is demonstrated when no unacceptable conditions are found in 58 randomly selected samples (or no more than one unacceptable condition in 92 samples; no more than two unacceptable conditions in 123 samples, etc.). The sample size for Diablo Canyon consisted of 98 supports which were selected as described in Attachment A.

The statistical theory involved assumes that the probability function  $P_n(m)$  of encountering (m) defects in a sample of (n) items selected at random from a total of (N) items is hypergeometric. This function can be approximated for (n) less than 0.10 N by the following binomial distribution:

$$P_n(m) = \binom{n}{m} p^m (1-p)^{n-m}$$

$$\text{where: } \binom{n}{m} = \frac{n!}{(n-m)!m!}$$

p = ratio of unacceptable supports to the total number  
supports = 0.05

The confidence level (c) is obtained from the following relationship:

$$c = 1 - \sum_m P_n(m)$$

Application of this statistical criterion to the Diablo Canyon expansion anchor sampling program resulted in a confidence level that exceeds 95%. Of the 98 supports in the sample, no condition existed which was found to reduce the safety factor below 3.

There was some concern that supports constructed prior to January 1975 were of questionable quality due to the use of 2-3/4" long Hilti Kwik-Bolts. When the pre-1975 installations are separated from the 98 random samples, 47 pre-1975 supports were found to have been sampled. In addition, 22 adjacent supports, also of pre-1975 vintage, were sampled, making a total of 69 pre-1975 samples. As each of these samples has been shown to have a factor of safety of at least 3, the conclusions stated above are valid for installations both pre- and post-1975.



#### Attachment D - Factors of Safety

The acceptance criteria for supports that were evaluated as a result of this sampling program has been defined in terms of factors of safety. The factor of safety is the ratio of the expansion anchor's average capacity to the maximum load the anchors are expected to experience. The magnitude of an acceptable factor of safety was discussed in the January 27, 1984 letter. A value of 3 was determined to constitute an acceptable number and was used to measure the adequacy of the individual supports evaluated in this sampling program.

Design loads on the raceway expansion anchors were developed in the Diablo Canyon Project (DCP) calculations. A criterion defining the methodology for analyzing the raceway supports was previously established by the DCP and was used in all cases reported herein. No special analysis techniques, refinements to the existing procedures, or removal of conservatisms inherent in the methodology were required to demonstrate a factor of safety of at least 3.

Anchor capacities were determined as described in the January 27, 1984 letter. Briefly summarized, the capacities were determined by averaging published test data on all of the types of expansion anchors in use at Diablo Canyon. Development of anchor capacities and factors of safety are contained in calculations prepared by the DCP.

In cases where installation concerns were raised, the anchor capacities were analytically reduced before calculating the factors of safety. The following is a list of the analytical reduction methods used for each type of concern:

##### Concern

##### Reduction Method

Short Embedment

Reduction in pullout capacities were made in proportion to pullout shear cone areas:

$$P_u' = P_u \left( \frac{L_{\text{actual}}}{L_{\text{required}}} \right)^2$$

where:

$P_u'$  = reduced pullout capacity

$P_u$  = pullout capacity for full  
embedment

$L_{\text{actual}}$  = actual embedment length

$L_{\text{required}}$  = embedment length  
required by Dwg. 054162

Spacing less than 10  
diameters or edge  
distance less than 5  
diameters

Reduction in pullout capacities were  
made using the equation given on Dwg.  
054162, except that full capacity was  
assumed to be developed at 10d  
spacings and 5d edge distances

$$P_u' = 2.25 P_u \left( \frac{N}{N+5} \right) \left( \frac{E}{E+2.5} \right)$$

where:

$P_u'$  = reduced pullout capacity

$P_u$  = pullout capacity at full  
spacing and edge distances

$N$  = no. of diameters of actual  
anchor spacing

$E$  = no. of diameters of actual  
edge distance

The above equation is very  
conservative when compared to test  
data.

Angular Alignment

For anchors installed within 15° of  
plumb, no reduction in anchor  
capacity was made. See Attachment E  
for further information on angularity.

Nut Engagement  
and Loose Nuts

Since so few cases of these types of  
concerns were found, they were  
addressed on a case by case basis.  
See Attachment E for further  
information.

Notwithstanding the conservative analysis techniques and the conservative  
methods used to reduce capacities for installation concerns, most supports  
have factors of safety well in excess of the acceptance limit of 3.

## Attachment E - Significance of Installation Concerns

This attachment addresses the sampling program findings for each type of concern. As described in Attachment D, anchor capacities were reduced to account for most of these concerns. The supports were then evaluated using reduced anchor capacities and were found to have factors of safety exceeding 3 in every case. This result, by itself, indicates that the concerns have not reduced safety margins to unacceptable levels. However, further conclusions can be made regarding the specific concerns.

### 2-3/4" Long Anchors

In the period prior to January 1975, a total of approximately 14,000 of the shorter (2-3/4" in length) Hilti Kwik-Bolts were bought by the electrical contractor. The total number of expansion anchors used in the Class I raceway supports was approximately 125,000. Some of the shorter anchors were used in Class I raceway supports. The concern with these anchors is that due to their short overall length, their embedment may not have been sufficient to maintain an adequate safety factor. These short anchors were found in 10 of the 98 randomly selected supports. Twenty-two adjacent supports were also sampled in which 6 supports were also found to contain the short anchors.

Every support, in both the random sample and in the adjacent support sample, that contained a short anchor was evaluated using the actual embedment to reduce the anchors's capacity. A factor of safety greater than 3 was confirmed in every case. As reported in the PGandE January 27, 1984 letter, the margin in the design of the raceway supports is large. The effect of relatively few short anchors on the overall safety was determined to be negligible. This conclusion has been confirmed by the random sampling program.

### Embedment

Fourteen of the 98 supports sampled contained anchors that did not have the embedment specified on Drawing 054162. Ten of these supports were those containing the short Hilti Kwik-Bolts. In most of the cases, the embedment was within 3/16" of the required embedment so the resulting reduction in pullout capacity was relatively small. Nevertheless, in all cases factors of safety greater than 3 were confirmed.

### Spacing

Of the 98 supports sampled, 17 had anchors spaced closer than 10 diameters (10d) from anchors in other supports. Most of these spacings were in the 7d to 9d range. Even after using the conservative reduction equation stated in Attachment D, all such cases were confirmed to have a factor of safety in excess of 3.

Also, 72 of the 98 supports were found to contain anchors spaced closer than 10d from another anchor in the same support. The inter-support anchor spacings are frequently less than 10d because manufactured fittings with predrilled holes are commonly used in the raceway support designs. These conditions had already been accounted for in the design calculations by neglecting one anchor or derating the capacity and they do not constitute deviations from design requirements.

#### Edge Distance

Two supports contained anchors spaced less than 5 diameters from concrete edges or embedded items. Both of these cases were evaluated and were found to be acceptable (factor of safety much greater than 3).

#### Angular Alignment

Eleven of the 98 sampled supports contained anchors installed between 5° and 15° out-of-plumb. In PGandE's January 27 letter, a discussion on the effects of anchors installed up to 15° out-of-plumb was presented. All available test data indicates that anchors installed within this tolerance perform satisfactorily. As a follow-up to the testing of misaligned anchors referenced in the January 27 letter, the testing of 1/2" diameter and 3/4" diameter Hilti Kwik-Bolts is now complete. The test report is currently being written. These tests demonstrated that there is no reduction in ultimate capacity for anchors installed within a nominal 10° tolerance (the tested angles ranged from 9° to 12°).

In the sampling of the "adjacent" supports, one support was found to contain 2 anchors installed at angles just over 15° (approximately 16° or 17°). This support has a factor of safety exceeding 10 and was, therefore, judged to be acceptable.

#### Miscellaneous Irregularities

As expected, a few supports were found to contain anchors with miscellaneous irregularities. All of these anchors were found acceptable for the reasons described below.

- o Loose nuts were found on four anchors. In one case, the loose nut occurred in an anchor installed in a base connection containing two anchors. The design required only one anchor in the connection. As one anchor in the connection was installed with no deviations, the loose nut on the other anchor is of no concern. In a similar case, one of two anchors in the connection did not have a nut. As the design only required one anchor, this condition is also acceptable. The other two cases were also evaluated and judged to be satisfactory even with one anchor nut slightly loose.



- o One anchor was found to be one thread shy of full nut engagement. The factor of safety on this anchor exceeded 10 and was, therefore, judged to be acceptable.
- o One anchor nut was observed to be damaged. The anchor was in a two-anchor connection whose design required only one anchor.

In a related, but separate investigation, the electrical contractor's QC inspection records were reviewed to identify cases in which anchors were (1) straightened to improve alignment, and (2) torqued to improve nut engagement.

In situations involving anchor straightening to improve alignment, only 11 cases were found (in the approximately 125,000 anchors addressed in the inspection records) which had their alignment corrected. Of the nearly 400 anchors inspected in the recent random sampling program, only one anchor showed signs of straightening. Even if all 11 of these affected anchors were realigned by hammering, the infrequency of occurrence eliminates this as a concern.

The results of this record review also found 317 cases in which anchors had been torqued to improve nut engagement. The inspection records addressed the installation of approximately 125,000 expansion anchors. Thus, torquing occurred in less than 1/2 of 1 percent of the anchors. This clearly has no significant effect on the overall safety margin in the raceway support systems. Further, load-deflection curves for expansion anchors show that the anchors deflect between 1/2" and 1" before their ultimate strengths are reached. Thus, torquing the bolts to engage one or two more threads, (which would deflect the bolt approximately 1/8") would not be cause for any concern.

As indicated earlier, raceway support systems are designed with the large factors of safety. From the results of the sampling program evaluations, it is evident that the factors of safety built into the raceway support design are large enough to tolerate an occasional irregularity in expansion anchor installation.

28c

DHE FORM 950 (11-81) NRCN 0070	U.S. NUCLEAR REGULATORY COMMISSION		REQUESTER'S MAILING ADDRESS	
	FACSIMILE TRANSMITTAL REQUEST		STREET	
			CITY	STATE
			DATE	RETURN ORIGINAL TO SENDER
		1450 MARIA LANE, SUITE 210		
		WALNUT CREEK	CA	
		3/6/84	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

MESSAGE TO		FACSIMILE PHONE NUMBER	VERIFICATION PHONE NUMBER
NAME AND ORGANIZATION			
HOWARD WONG			
CITY	STATE	AUTOMATIC	NUMBER OF PAGES (INCLUDING TRANSMITTAL INSTRUCTIONS)
EW/S		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	7

MESSAGE FROM		FACSIMILE PHONE NUMBER		VERIFICATION TELEPHONE NUMBER
NAME	TELEPHONE NO.	HIGH-SPEED (up to 1 min.)	LOW-SPEED (up to 1 min.)	
D. KIRSCH	3723	463-3804	463-3805	463-3773
BUILDING	MAIL STOP	AUTOMATIC	AUTOMATIC	
RV		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
		NO RAPID	NO 3 M	

PRECEDENCE				
OVERNIGHT	FOUR HOURS	TWO HOURS	ONE HOUR	IMMEDIATE

SPECIAL INSTRUCTIONS

Please review this to see if this adequately reflects your findings and conclusions. Please respond by telecon to D. Kirsch by noon, March 7, 1984.

TIME/DATE (Stamp)	
RECEIVED	TRANSMITTED

DK  
Final  
3-5-84

Task: Allegation or Concern No. 166

ATS No.: RV-84-A-0021

BN No.:

Characterization:

H. P. Foley Quality Control personnel are changing quality control documentation using general guidelines with no overall controls provided for problem documentation, review of changes by management, or management review

<small>NRC FORM 538 (11-81) NRCM 9878</small>  <b>FACSIMILE TRANSMITTAL REQUEST</b>	<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		<b>REQUESTER'S MAILING ADDRESS</b>	
			STREET	
			1450 MARIA LANE, Suite 210	
			CITY	STATE
		WALNUT CREEK		CA
		DATE	RETURN ORIGINAL TO SENDER	
		3/6/84		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

<b>MESSAGE TO</b>		
NAME AND ORGANIZATION		FACSIMILE PHONE NUMBER
Howard Wong		
CITY	STATE	AUTOMATIC
EW/S		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
		NUMBER OF PAGES (INCLUDE TRANSMITTAL INSTRUCTIONS)
		7

<b>MESSAGE FROM</b>			
NAME	TELEPHONE NO.	FACSIMILE PHONE NUMBER	
D. KIRSCH	3723	HIGH-SPEED (up to 1 min.)	LOW-SPEED (up to 1 min.)
		463-3804	463-3905
BUILDING	MAIL STOP	VERIFICATION TELEPHONE NUMBER	
RV		463-3773	
		AUTOMATIC	AUTOMATIC
		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
		NO RAPIDEX	NO 3M

<b>PRECEDENCE</b>				
<input type="checkbox"/> OVERNIGHT	<input type="checkbox"/> FOUR HOURS	<input type="checkbox"/> TWO HOURS	<input type="checkbox"/> ONE HOUR	<input type="checkbox"/> IMMEDIATE

<b>SPECIAL INSTRUCTIONS</b>
<p>Please review this to see if this adequately reflects your findings and conclusions. Please respond by telecon to D. Kirsch by noon, March 7, 1984.</p>

<b>TIME/DATE (DD/MM)</b>	
<b>RECEIVED</b>	<b>TRANSMITTED</b>

DK  
Final  
3-5-84

Task: Allegation of Concern No. 166

ATS No.: RV-84-A-0021

BN No.:

Characterization:

H. P. Foley Quality Control personnel are changing quality control documentation using general guidelines with no overall controls provided for problem documentation, review of changes by management, or management review of corrective actions.

Implied Significance to Plant Design, Construction or Operation:

Discrepant records may have been revised to reflect inspections and/or inspection criteria compliance, necessary to assure the verification of installation quality, which may not have been accomplished.

Assessment of Safety Significance:

The staff evaluation of this concern consisted of: (1) a review the procedures and criteria associated with the document review and revision process; (2) interviews with responsible licensee and contractor personnel; and (3) an examination of a sample of documentation packages to determine the types of record revisions which had been made and to evaluate if the revision made reflected the accomplishment of an activity which may not have been performed.



The staff examined the procedures and criteria associated with the document review and revision process. H. P. Foley Quality Instruction No. 4 (titled "Records Correction"), dated August 18, 1983, establishes the methods and actions required to alter, change, correct or modify quality documentation. Additional guidance is provided by a Foley Inter-Office Memorandum, dated October 6, 1983. These documents provide the Foley Quality Control personnel, engaged in the review and revision of quality documents, with the guidelines and authority necessary to correct obvious discrepancies noted during the document review process. Both documents provide requirements to assure that: the changes made are justified and do not mask the accept/reject status of the item; and the reason for changes made, which if not obvious, shall be indicated on the document or a separate attachment. The above guidelines provided to H. P. Foley personnel performing the document turnover reviews require that items identified as discrepant be documented on inspection reports, nonconformance reports or document deficiency notices (DDN's).

The staff found that neither of the above documents specifically provide for management review of, and concurrence with, each document revision or change; however, recurring deficiencies in the quality documentation have been brought to the attention of management for resolution in the form of inspection reports, nonconformance reports and document deficiency notices (DDNs). The staff found that management had acted responsibly in evaluating and resolving these issues.

As an improvement in the review process, the licensee committed, in their letter No. DCL-84-080, dated February 29, 1984, to specifically provide for management reviews of document changes. The staff conducted discussions with

responsible licensee and contractor personnel engaged in the document review and turnover process. These discussions indicated that, while senior level personnel were generally familiar with the total program for review and turnover of quality documents, the document review analysts did not have complete visibility of the total program and, thus, had reservations regarding the adequacy of resolutions provided in response to Document Deficiency Notices which they had written. These reservations seemed to be largely due to the lack of a complete explanation by the organization assigned to resolve the problem on certain document deficiency notices as to why the situations were resolved in the manner indicated on the forms. Therefore, when the completed package was returned to the document analysts they could not be sure the resolution was proper.

To assure that resolutions to identified problems are more adequately documented, the licensee committed, in their letter No. DCL-84-080, dated February 29, 1984, to revise Foley instructions to more adequately specify and provide for approval levels and documentation required for changes or corrections to quality records (this includes resolutions to deficiency notices). In the course of discussions with document turnover analysts, several examples of allegedly defective resolutions to document deficiency notices were provided to the staff. In order to resolve these concerns the staff examined the resolutions to 139 document deficiency notices (11 generic, 57 electrical, 40 mechanical and 31 civil) and examined 29 related purchase orders and 47 related file packages. In general, the staff was able to verify that the stated resolution was adequate. However, in 5 cases the resolutions provided did not appear to be justified. In two cases, Foley engineering had erred with the result that, in each case, the wire installed in a Class 1

circuit was not traceable to an accepted wire spool (Nonconformance reports were written documenting these discrepancies). One case involved a mere paperwork error with no effect on the installed circuits. In two cases, Foley engineering provided a response which could only be accepted if an actual field verification had been performed; however, there was no indication a field verification had been done. Subsequent reinspection by Foley verified that the two circuits were properly installed. Therefore, of the 139 deficiency notice resolutions reviewed only two DDNs were improperly dispositioned. PG&E elected to replace these cables. In the inspector's opinion there is a high probability that these two instances merely represent a failure to record the proper wire spool number on the wire pull card since the actual cables were color coded and PG&E had purchased color coded cable (other than black) to the requirements of the applicable IEEE standards. Thus, the staff has no real concern for the true acceptability of the cable which was installed.

The staff concludes that the overall controls, provided to quality control and document analysts, generally provided for adequate record discrepancy documentation. These controls could have been made more comprehensive and effective by specifically providing for management review of changes and management review of corrective actions. The staff found that, although not specifically required, management was involved in the document review and discrepancy correction process as evidenced by management's involvement in the review of recurring inspection reports, nonconformance reports and document deficiency notices.

The staff further concludes that the apparent confusion of document analysts regarding the overall document review and discrepancy resolution program did not result in an unacceptable level of document review and discrepancy resolution. This conclusion has basis in the results of the staff's examination of 139 of the more troublesome DDN resolutions, as detailed above. No real hardware problems were found.

Thus, the staff concludes that the identified concern, while true, is of only minimal importance and safety significance.

#### Staff Position

The staff considers that the general guidance provided personnel reviewing quality documentation, in preparation for turnover, to control the revision or changing of those quality documents was generally adequate. While the guidance did not specifically provide for management review and approval of each change, the staff finds that management was involved in the resolution of generic types of document changes and that management had generally provided controls over the types of changes which may be made and the documentation necessary to provide the justification for the change. With the further clarification of document change approval levels, the clarification of documentation required for quality record changes or corrections, and the increased training of quality control and document analysts, committed in the February 29, 1984 PG&E letter, the staff feels that the licensee's document review and turnover process will be further strengthened.



Action Required

None.

WRITE-UP: Foley - CHANGES TO  
QUALITY DOCUMENTS

H W N W  
REVISION 1/20/84  
9:00

29.

Task: Allegation or Concern No. \_\_\_\_\_

ATS No. \_\_\_\_\_

#### Characterization

H. P. Foley QC personnel are changing quality documentation (adding, <sup>e</sup>deleting, or modifying information) using general guidelines with no overall control for documenting problems, providing for management review of the problem and corrective action.

#### Implied Significance to Plant Design, Construction or Operation

Discrepant records may be revised to <sup>change</sup>~~reflect~~ inspections and/or criteria which are key to the quality verification of installations.

#### Assessment of Safety Significance

H. P. Foley Quality Instruction, QI-4, Rev. 1, Records Correction, dated August 18, 1983, establishes "the methods and actions required to alter, change, correct, clarify or modify Quality Control Documentation Record(s)." Additional guidance to H. P. Foley document review personnel is provided in an inter-office memo from L. Wilson to J. Thompson dated October 6, 1983, regarding "Correction of Quality Documents." The October 6, 1983, inter-office memo utilizes specific paragraphs of QI-4, Rev. 1 to provide guidelines on the authority and responsibility for correcting obvious discrepancies <sup>on</sup> ~~a~~ quality documentation for document review personnel.

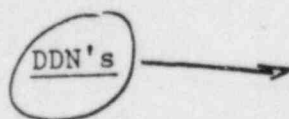
Both QI-4, Rev. 1 and the inter-office memo specify that the individual who changes quality documents is responsible that "the changes are justified and in no way masks the accept/reject status of the item." In addition, they both also state that when not otherwise apparent, the reason or justification for each change or addition to a document shall be indicated on the document or separate attachment. In certain instances as described detail in H. P. Foley Inspection Report IR 8802-1462, dated July 11, 1983, Weld Inspection Sheets (WIS) must be completed or completely remade using supplemental information such as the Work Process Traveler, Weld Withdraw<sup>al</sup> Sheets, and inspector's field notes. The IR stipulates that the completed WIS reference the IR and that it be co-signed by a QC supervisor. It is apparent that additional management attention was deemed necessary when actual QC records were being completed and not just corrected or modified.

In part, the allegation that quality documents are being changed with no overall control for documenting problems and providing management review of the problem and corrective actions was substantiated in that QI-4 nor the inter-office memo provides for such management control. However, there is evidence to indicate that generic deficiencies have been brought to H. P. Foley management attention for resolution such as inspection record deficiencies described in H. P. Foley NCR 8802-884, Rev. 1, procedural requirement violations described in NCR 8802-944, and the re-creation of Weld Inspection Sheets described previously. In addition, the guidelines provided to H. P. Foley personnel performing documentation turnover reviews specify that items identified as being discrepant in accordance with H. P. Foley Quality Control Procedure, QCP-3, Rev. 2<sup>5</sup>, Processing and Control of Nonconformances, dated

November 1, 1983, shall be identified on an IR or NCR. H. P. Foley non-QC personnel performing document turnover reviews utilize the Document Deficiency Notice (DDN) system to initiate changes to records which are not obvious. The DDN's are given supervisory review and have been letter-coded as to the type of document deficiency for each DDN. PG&E activity audit No. 83429A regarding DDN's has increased the awareness of personnel dealing with DDN's of the need to comply with QCP-3 should significant deficiencies be identified.

In interviews with H. P. Foley personnel performing documentation reviews, the initial attempt for any quality record change is to contact the originating person. If that person is no longer available, then the originating organization is contacted.

The NRC inspector reviewed a sample of DDN's and documentation packages as described below to determine the type and extent of records corrections or modifications <sup>made</sup> ~~required~~.



Number Sampled

Generics: G-001 thru 011

11

Electrical: E-001 thru 160

25 (approx.)

Generic: E-113 E-212

11

-153 -223

-207 -257

-210 -342

-211 -352

-471



Sample:	E-101	E-235
	-116	-365
	-120	-377
	-122	
	-144	-378
	-208	-442
	-209	-443
	-214	-400
	-218	-486
	-224	-430
		-429
		-386

21

Total Electrical = 57

Mechanical: M-001 thru 100

25 (approx.)

Generic	M-230
	-360
	-311
	-158
	-407

5

Sample:	M-005	M-206
	-021	-244
	-037	-308
	-138	-360
	-197	-145

10

Total Mechanical = 40

P. O.: P-621 thru 660  
-981 thru 1000

15 (approx.)

Generic:	P-528	3
	-977	
	-837	

Sample:	P-451	P-895	<u>11</u>
	-458	-1072	Total P. O. = 29
	-465	-1132	
	-528	-1153	
	-662	-1154	
	-728		

Civil: C-161 thru 200 25 (approx.)

Generic	C-024	1
Sample	C-005	<u>5</u>
	-025	Total Civil = 31
	-080	
	-110	
	-173	

# File Packages:

<u>Area</u>	<u>Number Sampled</u>
Electrical Circuits	30
Structural	5
Instrumentation	6
Civil	<u>6</u>
	Total Sampled = 47

From the review of the sample of file packages, the records corrections were of a minor nature and were made in accordance with the instructions of QI-4. For the most part, the review of DDN's indicated that deficiencies were being identified and adequate resolution provide, except in the case of the electrical circuit DDN's. Of the 57 total electrical DDN's reviewed by the NRC inspector, for 5 DDN's the resolution provided on the DDN did not justify the record change made. The five DDN's are described below.

DDN

Remarks

E-378

(NCR-8802-1015)

The response from the H. P. Foley engineer was incorrect in that the deficiency was not an "obvious transposition," but a real case of the loss of wire traceability.

E-377

The response from the H. P. Foley engineer bypassed document control where perhaps the error in the "documents-transmitted" sheet would have been identified. There was no effect on the circuits installed.

E-443

(NCR-8802-964)

(NCR-8802-1017)

From the response to WCR-8802-9<sup>6</sup>04 it is not apparent that the issue that a 20 foot length of wire has lost its traceability has been addressed.

E-365 and E-442

The response from the H. P. Foley engineer could be accepted only if actual field verification was performed. There was no indication that this had been done. Subsequent re-inspection reveals that the circuits are properly installed.

In the five of 52 instances described above, it is not apparent that the quality records change was properly justified as provided in response to the DDN's. This is in apparent <sup>deviation from</sup> ~~violation of~~ QI-4, Rev. 1, Section 5.1.3, which states that "when not otherwise apparent, the reason or justification for each change or addition to a document shall be indicated on the document or the separate attachment." (Note: PG&E <sup>H WING</sup> <sup>COMMON-</sup> <sup>NOT FOR</sup> <sup>INCLUSION INTO</sup> <sup>WHITING</sup> audit findings should be noted here)

#### Staff Position

1. It appears that there are sufficient management and procedural controls for documenting problems and the review of documentation problems when changes to quality records are being made. However, the NRC inspector recognizes that the authority for making record changes is not defined in QI-4. From a procedural standpoint QI-4 should be changed to comply with ANSI N45.2.9-1974, paragraph 3.2.6 which states that "quality assurance records may be corrected or supplemented in accordance with procedures which provide for appropriate review or approval by the originating organization."



2. It appears that quality records have not been substantially changed or modified <sup>to</sup> in any way reflect acceptable installation or inspections when actual condition are not so.
3. It is the NRC inspector's opinion that additional review of the responses to electrical DDN's be performed to assure that proper engineering judgement was used.
4. A general comment on the responses made to Engineering Disposition Requests (EDR's) in which only yes or no answers are provided is that more detail is needed in order to avoid later confusion. A brief description of the answer and the justification would give some insight into the basis of the response. Fifteen EDR's were reviewed and when researched all the responses were found to be acceptable.

### Actions Required

- 1) PG&E TO PROVIDE POSITION ON THE 5 DDN'S QUESTIONED AND WHETHER ADDITIONAL REVIEW ~~BE~~ SHOULD BE DONE BY PG&E/FOCUS OR EXTERNAL DDN REVIEWERS
- 2) PG&E TO PROVIDE AUPIT ON DDN REVIEW DONE DURING NRC INSPECTION

Markup Copy

30,

PGandE Letter No. DCL-84-

ENCLOSURE

QUALITY ASSURANCE RECORD REVIEW AND INSPECTOR QUALIFICATION

Foley Work History

In 1970 the H. P. Foley Company (Foley) was awarded a contract for electrical system installation activities at Diablo Canyon Power Plant (DCPP). Starting in 1977, Foley's role expanded and they became involved in other areas as assigned by PGandE. Following the initiation of the Diablo Canyon Project (DCP or Project) design verification program in 1981 to review the adequacy of plant design, the magnitude of the Foley work increased dramatically. The most significant increase in work began in November 1982 as a result of various modifications that were required in response to the verification program findings. This increased level of activity continued for nearly a year. Identified below are the major Foley tasks which required documentation and the year each task began. All of these tasks remain Foley's responsibility.

<u>Activity</u>	<u>Year Begun</u>
1. Electrical Equipment Installation	1970
2. Conduit and Raceway Installation	1970
3. Cable Installation	1970
4. Wiring Terminations (Connections)	1970
5. Instrumentation Tubing Installation	1977

<u>Activity</u>	<u>Year Begun</u>
6. Local Instrument Mounting	1977
7. Valve Maintenance	1977
8. Equipment and Support Grouting	1977
9. Structural Steel Installation	1979
10. Concrete Placement and Repair	1980
11. Installation of Platforms and Stairwells	1980
12. HVAC Duct and Support Modification and Maintenance	1981

#### I. RECORD REVIEW

##### Review by Foley

When Foley commenced work at Diablo Canyon, there were no NRC or specification requirements for quality assurance (Q.A.) records review. The Foley Q.A. Manual provided the guidance for all quality related activities until 1974. During this time duplicate records were sent to Foley Engineering and Quality Control Departments and to PGandE. From 1974 to 1977 Foley developed written procedures based on the Q.A. Manual, and distribution of duplicate records was eliminated. In 1976 Foley Q.A. did a comprehensive <sup>record</sup> audit <sup>based on</sup> ~~as a result of vague~~ statements in the Foley Q.A. Manual. In 1980 the <sup>need</sup> ~~results~~ Foley Q.C. manager directed the respective Q.C. supervisors to review all quality records from 1977 to 1980 and to review all future records before filing. <sup>"The audit found --"</sup> (By Memo? - TYPE OF REVIEW DONE?)

RESULTS?

From the start of Foley's work at the Diablo Canyon Nuclear Power Plant (DCNPP) through July 1983, the quality assurance records were generated by the responsible Q.C. inspector and reviewed and approved by the Q.C. inspector's supervisor. In addition, the responsible Foley quality control supervisor does a second informal review of the completed work package to assure technical adequacy. An administrative review of each document package was performed by Foley Records Management. The process of inspection and records generation review was audited by PGandE Q.A. and the NRC to verify that all requirements in effect at the time were met. All record discrepancies have been corrected.

From 1974 through 1980 Foley conducted 89 Q.C. audits, most of which included documentation. The audits covered such areas as .... The results were... Any problems were documented and resolved as part of the audit.

From 1977 through 1980 Foley's work force decreased to a relatively low level, during which time Foley had no engineering or scheduling responsibilities. The amount of quality documentation developed during this time was... PGandE inspectors and engineers checked with Foley crews directly to assure work was installed according to specifications. How much audit activity? Starting in November 1982, the Foley workload was significantly increased as a result of Due to the large increase in workload resulting from the design verification program, and the corresponding increase in personnel, Foley prepared detailed procedures to improve the training of new inspectors and the control of document review. Several Quality Assurance Instructions (QAIs) were issued in July 1983 to provide guidance for record review. These were applied to all ongoing activities requiring quality assurance.

*Handwritten notes:*  
? Explain improvements - Foley, how?  
? RELEVANT?  
Needs time in letter  
Does Not Follow Guidelines From 12 cross.  
? ?



Did Foley do this:  
or were they instructed by P&G-E?

To increase confidence in the accuracy and completeness of their records,  
at the insistence of P&G-E  
Foley decided to retroactively apply these QAIs in a review of all Project  
records since September 1981. This review of past records accomplished the  
following:

1. Reviewed all work done since November 1982 when the upsurge in work began as a result of the verification program modifications
2. Assessed the adequacy of records made during the informal program (prior to June 1983) by comparing them with records completed under the formal program (post-June 1983)
3. Included in the review all records for work completed since suspension of the initial fuel load license in 1981.

Records Review  
Done by WHO  
+ P&G - June 1983

The formal Foley document review program has been divided into two phases--a technical review phase and an administrative review phase. The technical review (Phase I) compares as-built drawings with field inspection documentation to assure consistency between these two elements. The technical review determines if the inspection documentation supports the as-built drawings by verifying items such as proper weld configuration, correct number of bolts installed, and material heat traceability. In the review of electrical work, which does not have as-built drawings, the inspection documents are compared to the modification or installation design sketches. Some random field inspections are performed to assure that the as-built conditions are accurately reflected in the documents. The Phase I review was started in October 1983 and was completed prior to fuel load for records

Comparison of as-built drawings  
+ inspection records  
NOT PHASE I  
II

generated since September 1981 and required for fuel load. Phase I review of an estimated 15,000 documents resulted in approximately a dozen nonconformance reports which were resolved with a very small amount of corrective work in the field. The Phase I review of the remaining records will be completed prior to the respective milestone activity.

How much?  
None!!

The administrative review (Phase II) checks the entire document package before turnover to PGandE. This review assures that the documentation which supports the program implementation is complete, correct, and properly cross referenced in the package indexes.

The Phase II review of records generated from September 1981 through July 1983 has been completed. During this review, Foley initiated 1400 document deficiency notices (DDNs) for these records. These notices were mostly the result of corrections to the documentation without the responsible person initialling the changes. To date, 1100 DDNs have been closed. Most of the 300 DDNs not yet closed involve vendor qualification on purchase orders. Purchase orders were not included in the Phase I review.

True?!

As a result of closing the 1100 DDNs, approximately 400 additional manhours were expended to investigate the concerns identified in the DDNs. No unacceptable work regarding the DDN concerns was discovered during these inspections; however, a few deficient conditions unrelated to the DDNs were discovered during the inspections, and subsequently corrected.

documented

A qualitative comparison between pre-June 1983 records and post-June 1983 records (i.e., between the informal and formal review program) discloses no difference in the quality or acceptability of the records. The Phase II review will be completed before commercial operations.

When the present Records Manager came into the Department in June 1981, the existing practice was for Q.C. clerks to review each package for completeness, followed by the Q.C. Clerical Supervisor's (now the Records Manager) and the Q.C. Supervisor's review of the package. This practice may have begun ~~some time~~ in 1979-1980.

*TIME? How  
was completeness  
determined by  
clerk?*

The preceding description of Foley's company policy and practice shows that the work records have been repeatedly reviewed according to the review requirements in effect at the time. Furthermore, any weaknesses found in the Q. A. program or discrepancies found in the records have been corrected. *the PGandE is fully satisfied the quality of work and the supporting documentation.*

Review by PGandE

#### *Construction*

Since 1970, the PGandE Quality Control Department has conducted over 200 activity audits of Foley work, the number of audits varying each year according to the amount of work performed. Activity audits review all aspects of the work associated with a particular activity. However, one of the primary purposes of these audits is to review the documentation associated with the work performed. Documentation discrepancies discovered during these reviews were documented and resolved in compliance with the discrepancy procedures in effect at that time.

① → (see page 20)

*which one?  
How closed?*

PGandE Construction Quality Control conducted audits of Foley's records in 1974, 1976, 1977, 1980 and 1982. A 1974 audit of Foley for review and control of documents recommended corrective actions that were implemented by Foley. A 1976 audit of Foley quality records associated with specification 8771, for which Foley was a subcontractor to G. F. Atkinson for construction of the control room complex, required corrective action. After completion of the corrective action by Foley, PGandE requested G. F. Atkinson transmit quality assurance documentation to PGandE <sup>Construction</sup> Quality Control.

An April/May 1976 audit of Foley purchase documents and procedures associated with specifications 8802/8807 required revisions to the Foley quality procurement program to assure Class I material was in compliance with quality requirements.

*Foley section*  
In May 1976 Foley initiated a series of Q.A. audits for Unit 1 records associated with specifications 8802/8807 prior to turnover of these records to PGandE. A total of thirteen audits have been identified which reviewed Unit 1 quality documents for these Specs. A Foley letter dated December 21, 1976, states each drawer of quality records will be spot checked to assure that the problems disclosed by the audits were adequately dispositioned.

*be more specific re problems disclosed in audits.*

*This leaves 10% of the records undetermined*  
*Construction*  
In February 1977 PGandE <sup>Construction</sup> Quality Control audited Foley to check the accuracy of all Unit 1 quality records associated with specifications 8802/8807 and the state of their preparedness for turnover to PGandE. At that time, an estimated 25% of the records were complete for turnover. Four minor problems were discovered in the 347 reports included in the audit. The audit



characterizes the accuracy of the records as good.

*Not sure this is from 1977!*

Summarizing the condition of the Foley quality records associated with specifications 8802/8807 as of February 1977, it can be seen that discrepancies in the records program had been identified and corrected and the records were accurate and ready for turnover.

A July 1980 audit of Foley procedures states Quality Control Procedure QCP-36, "Records," contains all of the elements for Criterion 17, *Appendix B*.

*Ch  
the*

*Describe revision, what was done? Are revisions minimal?*  
A November 1980 audit by Construction Quality Control of Foley termination records recommended revisions to Foley practice, although no discrepancy reports were issued.

No other Q.C. audits of Foley records were done from 1977 through 1981, since Foley did very little quality work during this period.

A January 1982 audit of Foley documents to verify closure of work before release to PGandE did not disclose any discrepancies other than clerical errors. Records for 1979-1981 were sampled in this audit.

An October/November 1982 audit of Foley document control determined that the work was performed satisfactorily; however, several clerical errors and procedure discrepancies (Ref: MVR E-2423, Rev. 1) were found and corrected.

Notes OGC 100 ?  
Not Documented

In May 1983, PGandE formed a records review group to audit a minimum of 10% of Foley's completed records generated between September 1981 and July 1983 for correctness and completeness. No significant findings resulted.

Since one of the primary purposes of these audits and inspections is to review the documentation associated with the work performed, PGandE modified its review process in 1983 by replacing most audits with inspections. Because audits review all aspects of the work associated with a particular activity, whereas inspections address specific tasks within the activity, PGandE felt inspections would be more appropriate than audits.

7  
This  
does  
fit  
here

on the Project

In May 1983, PGandE formed a records review group, to conduct an administrative review of a minimum of 10% of Foley's completed quality records generated between September 1981 and July 1983. This review was independent of the Foley review of records for this same time period and was intended to provide added assurance that no major deficiencies existed in the Foley's records. This administrative review was actually a 100% review, and verified completeness, correctness, and legibility of the records. Only minor administrative discrepancies were revealed which required no further inspection. Again, qualitative comparison of pre-June 1983 records with post-June 1983 records disclosed no difference in the quality or acceptability of the records.

WHEN  
DOCUMENT ?

Construction Quality Control records review group

PGandE will conduct an additional administrative review of a minimum of 10% of all Foley quality records (since 1970) before these records are given accepted to PGandE. This review will meet the ANSI requirements standards for review

of records before turnover from contractor to owner. PGandE review and receipt of records will begin when the Foley record turnover procedure has been finalized and approved by PGandE. PGandE turnover review will be completed before commercial operation.

*Phase Construction Quality*

*Control* Additionally, a 100% administrative review is performed by PGandE's  
Records Management ~~System (RMS)~~ group prior to turnover to Nuclear Power Operations (NPO).

*In addition,*

1 PGandE Quality Assurance has conducted over 100 audits of Foley's work from 1970 to 1981, and 92 additional audits in 1982 and 1983, most of which included reviews of any documents associated with the work activity.

→ (1)

## II. INSPECTOR QUALIFICATIONS

From 1970 through April 1981, formal certification was not required for Foley ~~Q. A.~~ <sup>quality</sup> personnel; however, requirements and responsibilities for training Q. A. personnel were in effect.

Quality control personnel were given inspection assignments based on interviews by Q. A. management to determine the inspector's education and previous experience. Training was designed to acquaint inspectors with department procedures and the requirements of any new assignment. New inspectors were assigned to experienced inspectors who provided them with on-the-job training. Documentation of on-the-job training was not required. An inspector was never assigned to make an inspection independently unless his

Rich Wilson  
Time?

ENTRANCE INTERVIEW  
CONTINUING SPECIAL INSPECTION  
1/4/84

S. D. Reynolds, Jr.	Lead Reactor Engineer Materials & Welding Specialist Car (1GUG427 CA)	Region I	122
D. A. Rockwell	Project Field Engineer		
Kirk Glenn	G.C. Q.C. Supervisor		
J. R. Fair	Senior Mechanical Engineer I.E. Car (1FZE647 CA)		222
D. Wickard	P.T.G.C.		
L. E. Rosetta	Project Field Completion Manager		
Albert B. Ruff	U.S. - NRC Reactor Inspector 1976 Capri (919 NMQ CA Yellow)	Region II	230
P. J. Morrill	Reactor Inspector	Region V	124
G. H. Hernandez	Reactor Inspector 1980 Toyota (1BAV686 White)	Region V	128
Grant Glascock	Electrical Resident, P.T.G.C.		
Jerry Arnold	P.T.G.C.		
E. H. Girard	NRC - Reactor Inspector 1983 Reliant (1E0Z233)	Region V	228
W. J. Wagner	NRC - Reactor Inspector	Region V	130
D. Kirsch	NRC	Region V	126



DOCUMENT TURNOVER SECTION

—	THURMAN ALLEN	4012	ANALYST	6-1-77
	JANET ANDERSON	2175	ANALYST	6-1-77
10:00	LAURIE BARGER	1053	ANALYST	7-0
	GARY BOLING	2071	DOC. TURNOVER SUPERVISOR	
— 9:30	BRUCE BRIGGS	2418	ANALYST	6-1-77/2-1-78
	BETH CAIN	2199	CLERK	
	GRADY CASHWELL	2458	ANALYST	9-0 (out)
	RAY DAVIS	2178	ANALYST	6-1-77
	VERLON DAVIS	4091	ANALYST	6-1-77/2-1-78
	TINA ELLEDGE	4444	CLERK	
	LESTER ELLEDGE	4015	ANALYST	6-1-77
	ROBIN FOSTER	2277	CLERK	
	JOY GUY	2381	CLERK	
9:00 —	WOODY HUDSON	2392	ANALYST	6-1-77
—	BILL McCLENDON	2417	ANALYST	6-1-77
	JEANINE McVICKER	099	CLERK	
	BEVERLY RANDELL	2200	CLERK	
—	CHARLES ROBERSON	4018	ANALYST	6-1-77
	CAROL RODENHI	2374	CLERICAL SUPERVISOR	
	CHERYL SCHAFER	4442	CLERK	
	DON SHEALY	065	QA SUPERVISOR	
—	RUSSELL STROUD	4010	ANALYST	6-1-77
	MARY TROUT	2385	CLERK	
	VICTOR WRIGHT	2070	CLERK	

WARD H. FOLEY COMPANY  
DOCUMENT DEFICIENCY NOTICE

ITEM IDENTIFICATION: \_\_\_\_\_  
LOCATION/UNIT: \_\_\_\_\_

REVIEWER: B.B.

DEFICIENCY DESCRIPTION:

DEFICIENCY IDENTIFICATION 8837, SECTION 5.  
PARA 3. REVISION BY PG&E WORK REQUEST C-6649.  
A MINIMUM OF 1/8" OF FULL PENETRATION WELD SHALL  
BE USED IN ALL AREAS WHERE NOT SPECIFIED ON  
DRAWING. ADDITIONAL IS FOUND IN WRC-6649  
TO INDICATE WHERE WELDS WERE PERFORMED.

FOR INFORMATION ONLY

Steve Briggs 6-22-93  
(SIGNATURE) (DATE)

DEPARTMENT: EC

INDIVIDUAL: L. ETOLE

CORRECTIVE ACTION:

WORK OFFICE  
1. Check for any particular up plan

5.26 9-13-83  
(SIGNATURE) (DATE)

# OR INFORMATION

WORK REQUEST  
CLASS 1

NO. C-6049

INITIATED BY:

DATE: 2-1-82

DIRECTED TO:

THE HOWARD P. COMPANY  
PROJECT MANAGER

QUALITY CONTROL  
DIABLO CANYON

REVIEWED & APPROVED

DBH

DATE: 2/2/82

REQUIRED DUE DATE:

PROVIDE THE NECESSARY TOOLS AND MATERIAL TO CUT OUT  
APPROXIMATELY 4 INCHES OF THE 1/2" CH'D FLOOR PLATES  
SO AS TO FACILITATE WORK ACCESS FOR MODI-  
FICATIONS REQUIRED BY THE MECHANICAL DRUGS #4602-  
53 AND 4602-54. THE CUTS ARE LOCATED IN THE UNIT  
TWO TUBS. THE CUTS ARE AT VARIOUS LOCATIONS INDICAT-  
ED ON THE ATTACHED DRAWINGS. COORDINATE WORK AND VERIFY  
CUTOUTS WITH THE FULLMAN POWER PRODUCT'S FOREMAN  
BOB FAULL. THE WORK HAS BEEN COMPLETED BY OTHERS.  
REINSTALL THE REMOVED PLATE WITH FULL PAUL-  
TRATION WORK. WORK IN ACCORDANCE WITH SPEC  
8037 WITH THE REQUIRED PERFORM MAGNETIC PARTICAL  
EXAMINATION. THE EXAMINATION NEEDS IN PLACE OF U.T.  
COMPLIANCE: ACCORDING TO THE ACT 62-57-82

COMPLIANCE:

DATE: 5/17/83

QCR

DATE: 3/1

PACIFIC GAS AND ELECTRIC  
RESIDENT ENGINEER

THE HOWARD P.  
PROJECT MANAGER

DATE: 2-2-82  
(Date)

DATE: 2-4-82  
(Date)



CANYON  
PROJECT

NO YES  
Call constitutes  
a Design Change ☒ ☐

Design Change Request Number

Copy is to be returned to  
Engineering Department for ☒  
their information

OF

INFORMATION ONLY

PERSON CALLED:

DATE CALLED:

SUBJECT:

LOCATION:

DRAWING NO.

REASON FOR CALL:

SO AS TO

DRAWINGS.

QUESTION: (1) ARE

APPROXIMATELY

(2) WHAT TYPE

PLATES?

(3) MAY WE USE

DATE OF REPLY:

REPLY RECEIVED:

ACCESS HOLES ON EXISTING 2" CHE'D FLOOR

BETWEEN COL. LINES 20-22, D-1

SPLC. NO.: 8837 4R NO.: 8808

ADD 460254 REV. 5

WORK REQUIRED BY THE ABOVE

SECTIONS OF FLOOR PLATE AT

LOCATIONS AS REQUIRED?

RE-INSTALLATION OF CUT OUT

EXAMINATION IN PLACE OF ULTRASOUND

WITH FULL PENETRATION WELDS.

RECEIVED

DOCUMENT CONTROL

MAY 24 1962

NOT TO BE USED FOR CONSTRUCTION

No Reproduction



THROUGH

Call constitutes a Design Change	NO <input checked="" type="checkbox"/>	YES <input type="checkbox"/>
Design Change Request Number		
Copies to be returned to Engineering Department for their information		

# INFORMATION ONLY

RECEIVED  
JUL 17 1962  
MAY 11 1962

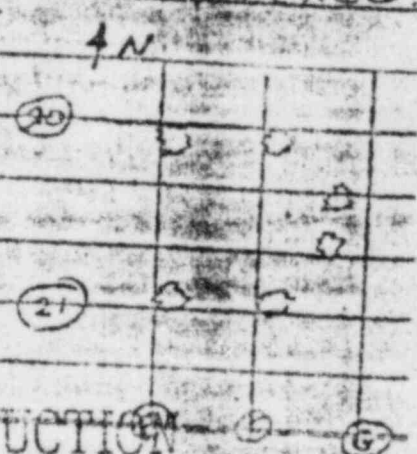
TYPE (5412)  
FOR

PERSON CALLED:  
DATE CALLED:  
SUBJECT:  
LOCATION:  
DRAWING NO.  
REASON FOR CALL:  
DATE OF REPLY:  
REPLY RECEIVED:

in concrete  
bottom side of  
cut-out 3'-6"  
rest of wall  
cut-outs in  
2) may we  
with full  
concrete to

cut-outs  
chase bldg. (ENH)  
CHAS. 2 SPEC. NO. 5472/8711 4R NO.  
53. Mah. DEPT. to install chase  
install or used changes from  
and would like civil dept. to  
is change plate (so con  
1) may we make 3'-6" x 3'-6" x 6"  
in place in Opp. 6-8 Location?  
cut-outs back later and used back  
lookup plates? 3) may  
And Visual Inspect only? 4) Is

Location shown  
in 6-8 of 6-8



NO INFO ONLY  
FOR CONSTRUCTION

Not for reproduction



December 21, 1976

L. E. Addleman  
Project Manager  
Post Office Box 327  
Avila Beach, California 93424

ATTENTION: V. Tennyson

RE: P.G.&E. Contract  
22C-8802-2  
Our Job Y-573

Quality Assurance  
Unit I Document  
Turnover Audits

Gentlemen:

A revised audit program of the Unit I documents scheduled to be turned over to the Pacific Gas and Electric Company has been initiated as stated in our letter dated September 8, 1976.

The progress of the audit program is such that a summary of the findings can be made. The following list has been compiled for the purpose of outlining the types of problems now being addressed in the preparation of these documents for final turnover to the customer.

As the audit findings are closed for each file drawer, they will be spot-checked to assure that the types of problems outlined here have been adequately dispositioned and addressed throughout the file drawer.

Sincerely,

*D. Parrish*

D. Parrish  
Quality Assurance Manager

cc: R. Grant  
R. Wadlow

THE  
HOWARD P. FOLEY  
COMPANY  
P. O. BOX 327,  
AVILA BEACH, CALIF.  
93424  
805-595-2322

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WASHINGTON, D.C.

Canadian Subsidiary:

EDMONTON, ALBERTA

## I. RACEWAY FILES

1. Inspection records completed improperly
2. Welds inspected without subsequent raceway re-inspection
3. RIWS verifies welds without weld inspection documents
4. Open discrepancies remain on inspection records
5. Size, type, and vitality differ from raceway schedule
6. Class I raceway inspection record not available
7. File index sheet references are incomplete
8. Inspection record verifying completion of C.O. not available

## II. JUNCTION AND TERMINAL BOXES

1. Box sizes differ on inspection records, prints, and equipment code

## III. SUPPORT INSPECTION FILES

1. S.I.W.S. verifies welds without weld inspection documents
2. Open discrepancies remain on inspection records

## IV. HEAT TRACE FILES

1. Maintenance and Protection records are not completed
2. All MVR's listed on index are not in files
3. EIR's are on file for controller and cable installation
  - a. M-76 forms on file dated after equipment installation
  - b. MPIR forms discontinued without explanation
  - c. RIR forms note open discrepancies

## V. EQUIPMENT FILES

1. EIR data transcribed from earlier document without reference note

## VI. TERMINATION INSPECTION FILES

1. Inspection records completed improperly
2. Continuation sheets, identifying discrepancies and re-inspections, are missing
3. Number sequence duplication

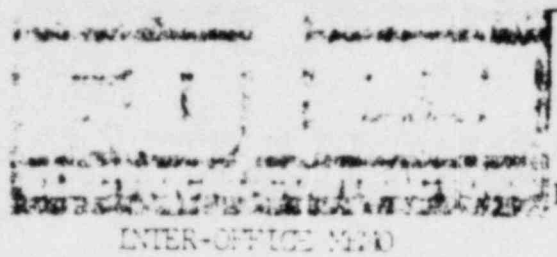


## VII. CIRCUIT RECORD FILES

1. Determination requests issued prior to recorded terminations
2. Circuits reterminated without determination requests
3. Terminations recorded prior to completed installations
4. Original installation records not available
5. Splice wire traceability not available
6. Single conductor circuit lists two wire reel numbers
7. Recorded wire reel differs from wire schedule requirement
8. No records available for Class I circuits
9. Installations/terminations not yet complete
10. Index cards not completed



1970 To: Tim Thompson



DATE: 8/10/83  
Page 1 of 3

INTER-OFFICE MAIL

TO: Records Management Department/Eleanor Smullen  
FROM: Document Turnover Section/Don Shealy  
SUBJECT: Document Turnover Review

This letter is intended to help clarify what the Document Turnover Section is doing and why we need your support.

Document Turnover's function is to perform an administrative review of all closed files prior to these files being turned over to the owner, P.G. & E. We check each closed file for two main criteria - "completeness" and "correctness". "Completeness" for us is defined as a file having all necessary backup documentation as can be ascertained from the work initiating document within the file package. "Correctness" for us is defined as the file documents having proper references, all acceptance points and hold points addressed, etc.

The first step in the Document Turnover review process is Clerical Review. A clerk prepares the file for the analyst using a Data Input Checklist (DICL). First, they compare the index sheet items to the actual contents of the file folder. The clerk hi-lites on the index sheet all reports, inspection documents, etc. contained within the file. Missing documents or extra documents are noted on the DICL. Secondly the clerk identifies on the DICL all cross-reference items - such as IR's, NCR's, DCN, Drawings - that will go into the computer. Third, the clerk will make note of any obvious problems in the file regarding 'corrections' and 'completeness'. At this point the Data Input Checklist is placed within the file folder and returned unsealed to the vault. The file is then ready for review by the analyst. (NOTE: some file cabinets were too crowded to hold these DICL's and it was necessary to keep them in Document Turnover Section). The file that Document Turnover clerks have thus prepared will be labeled on the file drawer with a Document Turnover Section red label.

After this clerical review, the file will be reviewed by the analyst. He/she will perform a more in-depth review of the file, again checking for "completeness" and "correctness". A file that has deficiencies will have a Document Deficiency Notice (DDN) identifying these problems. These Deficiency Notices (DDN's) are sent to the responsible departments for resolution.

THE  
HOWARD P. FOLEY  
COMPANY  
P. O. BOX 327,  
AVILA BEACH, CALIF.  
93424  
805-595-7377

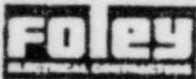
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- TUCSON, ARIZONA
- WASHINGTON, D.C.

When the analyst has determined that a file is both "complete" and "correct", the analyst signs the Data Input Checklist attesting that the file has been thus reviewed. The file is then sealed with a Document Turnover label. At this point the file has been reviewed and information regarding the file entered into the computer. Ideally, the sealed file should be shipped off to P.G. & E. as a turnover package. Unfortunately, this physical "turnover" to P.G. & E. will not occur until much later. Therefore the sealed file must remain in the Records Management Section Vault.

Knowing this procedure, you can see that it is very critical that these files be carefully controlled. Once the clerical review or analyst review has been done, the Document Turnover Section must be notified of any change made to these reviewed files.

- (1). If any changes to a reviewed file are made, or a file become closed, notify the Document Turnover Section using the Inter-Office Memo for "Notification of Record Status Change" (ATTACHMENT #1). Indicate with a check mark whether this is "Newly Closed" or "Info Change Only".
- (2). Should any of the sealed files need to be opened, the following should be done.
  - (a). If the file is only reviewed and no changes are made, put a "File Follower" (ATTACHMENT #2) into the file. Under "Action Taken" write "Reviewed Only". Put "NO" under "Update Required" and sign and date. Finally, seal the file with a Records Management Section seal, initial and date it.
  - (b). If the file is changed, notify Document Turnover Section with the "Notification of Record Status Change". Complete a File Follower to indicate exactly "Action Taken" and sign/date. DO NOT Seal the file. Notify Document Turnover of the file being unsealed with a "Notification of Record Status Change" Memo.



THE  
HOWARD P. FOLEY  
COMPANY

If you have any questions regarding what Document Turnover personnel are doing, please ask us. We need to maintain an open line of communication between our two groups. We are all working on the same files. It is everyone's best interests to see that they are well maintained.

Thank you for your cooperation.

*Don Shealy* 8-10-83  
DON SHEALY DATE  
Document Turnover Section



THE  
HOWARD P. FOLEY  
COMPANY

TO: Document Turnover Section

FROM: Records Management Department

SUBJECT: Notification of Record Status Changes

The following records were processed by our department. This list is submitted for your disposition.

FILE TYPE: \_\_\_\_\_

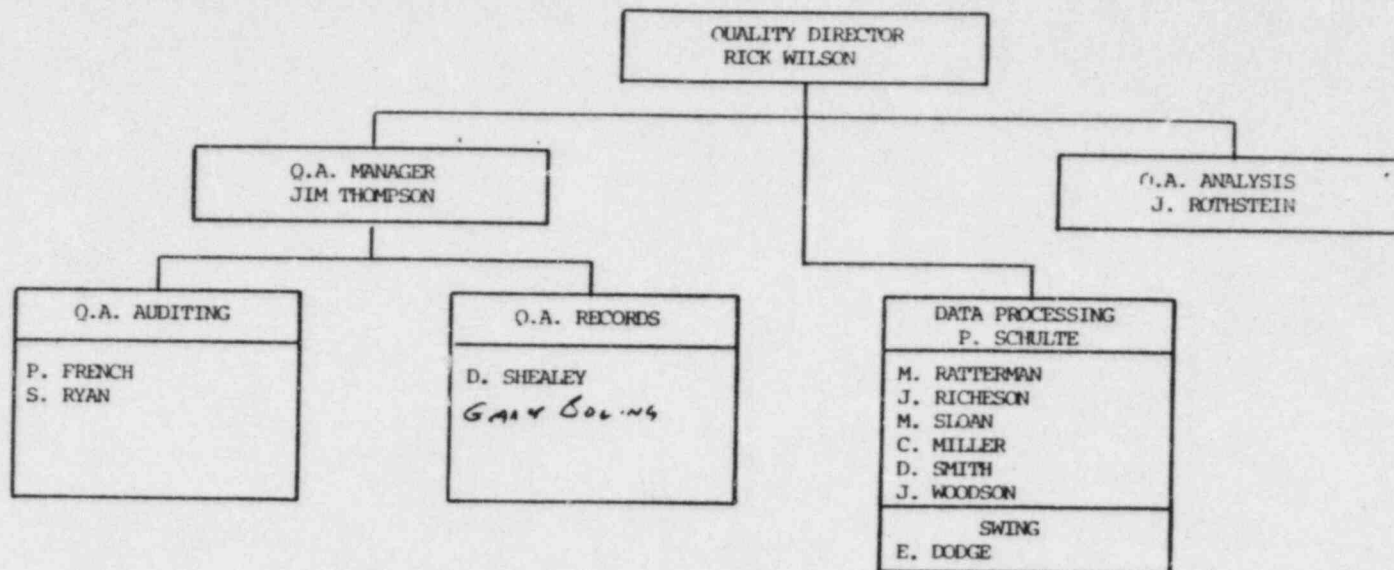
[illegible]

EDMONTON, ALBERTA

DATE \_\_\_\_\_



[illegible]



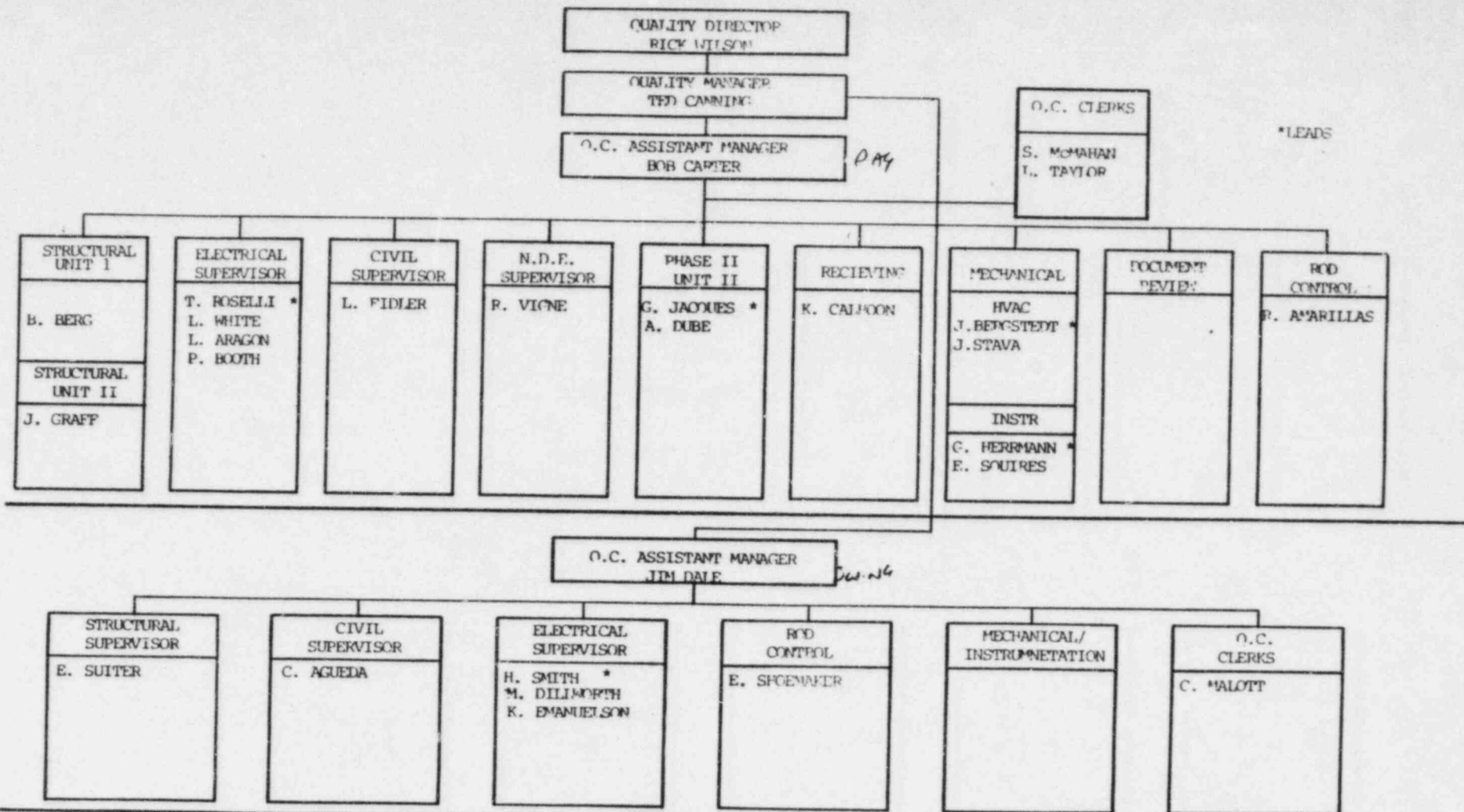
**FOI**

DIABLO CANYON PROJECT

**QUALITY ASSURANCE**

11/83

796



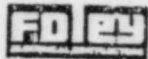
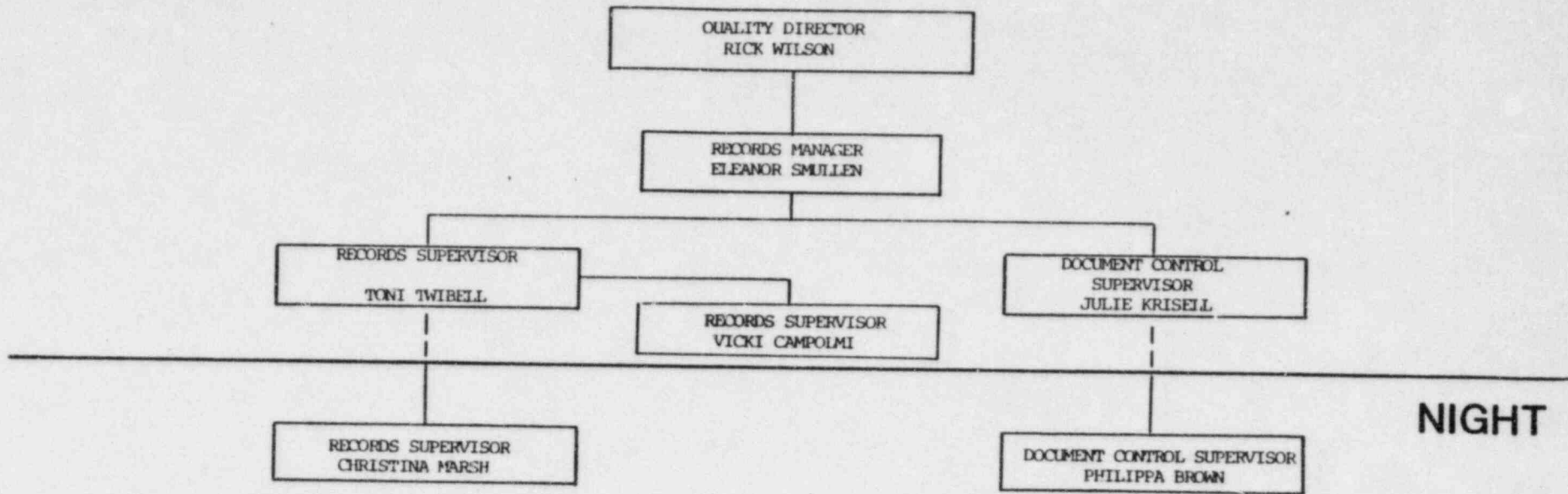
**Foley**

DIABLO CANYON PROJECT

**QUALITY CONTROL**

11/83

8



DIABLO CANYON PROJECT

RECORDS MANAGEMENT &

DOCUMENT CONTROL

11/83



TO: J. Thompson, Q.A. Manager  
FROM: L. K. Wilson, Quality Director  
SUBJECT: Correction of Quality Documents  
DATE: October 6, 1983

This memorandum provides the document review personnel with the authority and responsibility for correcting obvious discrepancies on Quality documentation within the following guidelines:

Each individual who adds or, deletes information or otherwise modifies Quality documentation, has the responsibility to assure that the changes are justified and in no way masks the accept reject status of the item.

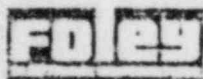
If supplemental information must be added it may be noted on document or, if required for clarity, it may be noted on a separate document. In either case the addition must be initialed and dated.

When the reason for a change is not self evident, a brief explanation will be included.

If the documentation is of such quality that a reproduction would be illegible the pertinent parts of the document may be darkened for legibility. A notation "Darkened for Legibility" will be added to the document; initialed and dated.

RW:tt

Note: Supersedes memo dated 9/26/83



THE  
HOWARD P. FOLEY  
COMPANY

TO: J. Thompson, O.A. Manager

FROM: L. E. *Rush*, Quality Director

SUBJECT: Correction of Quality Documents

DATE: September 26, 1983

This memorandum provides the document review personnel with the authority and responsibility for correcting obvious discrepancies on Quality documentation within the following guidelines:

*APPEARANT* *Typos:*  
*ANSWER* → *ASTUTE*  
*MARKS* → *MARKS*

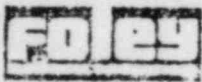
Each individual who adds or, deletes information or otherwise modifies Quality documentation, has the responsibility to answer that the changes are justified and in no way marks the accept reject status of the item.

If supplemental information must be added it may be noted on document or, if required for clarity, it may be noted on a separate document. In either case the addition must be initialed and dated.

When the reason for a change is not self evident, a brief explanation will be included.

If the documentation is of such quality that a reproduction would be illegible the pertinent parts of the document may be darkened for legibility. A notation "Darkened for Legibility" will be added to the document; initialed and dated.

EW:ct



THE  
HOWARD P. FOLEY  
COMPANY

Superseded by 10-6-83 Date 10-6-83  
MEMO *JS*



June 29, 1976

L. E. Addleman  
Project Manager  
The Howard P. Foley Company  
P. O. Box 327  
Avila Beach, California 93424

RE: Standard Practice Methods

Gentlemen:

Attached is a method outline of standard practices for revising and correcting documents maintained by The Howard P. Foley Company at the Diablo Canyon Site. The need for standard methods was made evident by Audit DT-1.7 conducted by John Collins. In the General Comments of the Audit he noted that "in some cases, original data had been scratched out or whited out and the initials and date of the person altering the data was not in evidence". Research within my Department and discussions with other Department Managers indicates that corrections are made by the most expedient method as determined by the person requiring the change, also that methods used by each person have varied with time and circumstance.

I feel that the use of these guidelines by The Howard P. Foley Company personnel on this jobsite will greatly increase the credibility of the records we maintain.

Sincerely,  
*Virgil Tennyson*  
Virgil Tennyson  
Quality Manager

THE  
HOWARD P. FOLEY  
COMPANY  
P. O. BOX 327,  
AVILA BEACH, CALIF.  
93424  
805-595-2322

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Canadian Subsidiary:  
EDMONTON, ALBERTA

PF/sc  
Attachment



June 29, 1976

MEMORANDUM

TO: Virgil Tennyson  
FROM: Peter Ferini  
SUBJECT: Standardization of Methods for completing, correcting, changing or supplementing Permanent Records and other Documents.

Recent review of documents for turnover to the Pacific Gas and Electric Company suggests that standard methods for making corrections to documents be established. Of particular importance are corrections to customer furnished documents and H.P.F. documents which will be turned over to the Pacific Gas and Electric Company. Considering the variances of methods used in completing, revising and supplementing documentation by The Howard P. Foley Company personnel at the Diablo Canyon Project, I suggest that we establish a company standard for use on this job. Attached is a method outline for your consideration.

A handwritten signature in cursive script, appearing to read "Peter Ferini".

THE  
HOWARD P. FOLEY  
COMPANY

P. O. BOX 327,  
AVILA BEACH, CALIF.  
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805-595-2322

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June 29, 1976

## STANDARD PRACTICE METHODS

### 1. Initiation and Completion of Documents of Record.

- a. All forms and reports initiated to become a document of record shall include the initiators identification and the date initiated.
- b. All documents of record shall be completed to requirements of the procedure governing its use.
- c. All entries, attachments and supplements to documents of record shall be written in ink.
- d. All corrections to documents of record shall conform to Paragraph 2 except:
  - 1) Where the document has not been completed nor circulated or distributed for use, the initiator may implement a new document without revision.
  - 2) Errors made in typing may be eradicated during typing.

### 2. Supplemental Information to Documents of Record.

- a. Documents of record shall be corrected or supplemented by the following methods provided that approval of the originating department is obtained.
  - 1) Corrections shall only be valid when made to the original document and/or the copy of record.
  - 2) Corrections shall be made by lining through the item to be corrected and printing the correction in adjacent to the lineout. The identification of the person authorized to make the correction and the date of correction shall be entered adjacent to each correction made.
  - 3) Corrections may be made by revision or supplement to the original document. Revisions and supplements shall require the same review and approvals as the original document.

39.  
U. Jernys

THE HOWARD P. FOLEY COMPANY  
INTER-OFFICE COMMUNICATION

All Department Managers

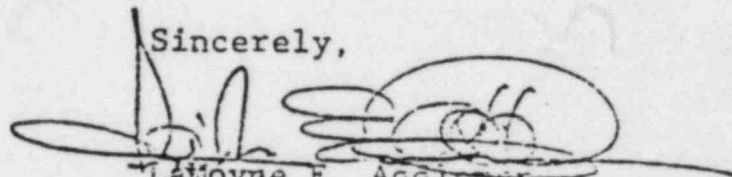
August 3, 1976

Lamoyne E. Addleman

In order to communicate and document accomplishments with a minimum of confusion, it is required that we set and observe certain working standards. Attached are Standard Practices and Methods for: initiating, completing, correcting, changing or supplementing permanent records and other documents; and for controlling standard form, tags and inking stamps. Other Standard Practices and Methods shall be issued when their need becomes apparent.

These Standards shall be observed by all personnel. Any questions regarding this subject should be brought to my attention.

Sincerely,



Lamoyne E. Addleman  
Project Manager