LILCO
LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY
SHOREHAM NUCLEAR POWER STATION
P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

SNRC-575

May 28, 1981

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Equipment Dynamic Qualification - Supplemental Information
SER Outstanding Issue No. 8
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Dear Mr. Denton:

Submitted herewith are ten copies of technical data to supplement our letter SNRC-564, dated May 15, 1981. Four copies of this submittal are being forwarded directly to Dr. Morris Reich at Brookhaven National Laboratory, in accordance with Mr. R. L. Tedesco's letter to LILCO dated January 28, 1981. This submittal includes the following enclosures:

Enclosure 1 provides the frequency analysis of the support frame for pressure transmitter 1C61*PT006 (C61N006), selected equipment Item 4. A commitment to provide this calculation was made in Item 4 in Attachment II to SNRC-564.

Enclosure 2 provides change pages containing revisions to Attachments II and III to SNRC-564. Revised lines are indicated by a vertical line in the right-hand margin. Equipment Item 4 changes reflect the determination that the pressure transmitter is a passive device. Equipment Item 19 changes reflect the determination that the field mounting configuration description in the original submittal was incomplete. Equipment Item 5 changes show the correct test results for this level switch in the high-frequency range.

B001
S. 1/1

8106020524

E

The calculation summary and example computer analysis described under Item (3) in Attachment I to SNRC-564 will be provided later. Except for this analysis, this supplement completes our submittal of information requested by the SQRT team at their site visit exit interview in April, 1981.

We believe that the SQRT site review, supplemented by this and previous submittals, provides an adequate basis for closure of the issue of Shoreham equipment dynamic qualification.

Very truly yours,

J. P. Novarro

J. P. Novarro
Project Manager
Shoreham Nuclear Power Station

JFE:mc

Enclosures

cc: Dr. Morris Reich
Mr. J. Higgins

ENCLOSURE 1

Frequency analysis for Item 4
of Attachment II to SNRC-564

Long Island Lighting Company
Stone and Webster - AE
General Electric - NSSS

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	~~OPTIONAL TASK CODE~~	PAGE 1
11600.02	EMD		NSSS-4	TOTAL 10 PGS.

BY S. TUNG 5/23/81

PRESSURE TRANSIMITTER (IC61*PT006) @ EL. 79'

FUNDAMENTAL FREQUENCY CALCULATION

1. ANALYSES HAVE BEEN PERFORMED TO CALCULATE THE FUNDAMENTAL FREQUENCY OF THE WALL-MOUNTED INSTRUMENT STAND WITH PRESSURE TRANSIMITTER IC 61*PT 006. HAND CALCULATIONS WERE USED TO CALCULATE THE FREQUENCIES OF THE SUPPORT BEAM BENDING AND TORSIONAL MODES. A "STRUDL" FINITE ELEMENT MODEL WAS USED TO DETERMINE THE LOWER FREQUENCY FLEXURAL MODES OF THE PLATE.

2. A SKETCH OF THIS STAND IS SHOWN ON PAGE 2. ITS "STRUDL" MODEL IS SHOWN ON PAGE 3. THE 2" SCH. XS PIPE IS "RIGID" (150 HZ BENDING FREQUENCY) AND IS THEREFORE REPRESENTED BY SIMPLY SUPPORTING THE SHADED ELEMENT.

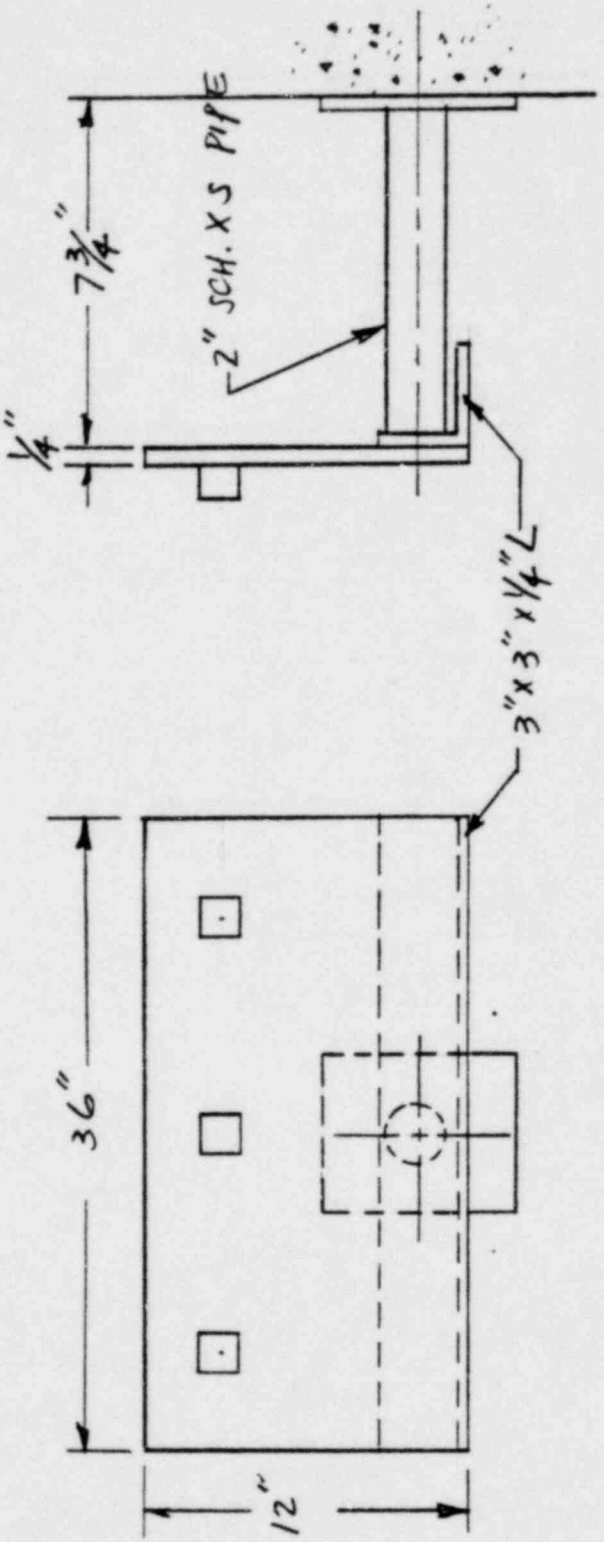
3. RESULT: FUNDAMENTAL FREQUENCY = 40 HZ, ASSOCIATED WITH A LOCAL PLATE BENDING MODE.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 2
11600.02	EMD			



WALL-MOUNTED STAND WITH 1C61*PT006 INST.

NOT TO SCALE

STONE & WEBSTER ENGINEERING CORPORATION

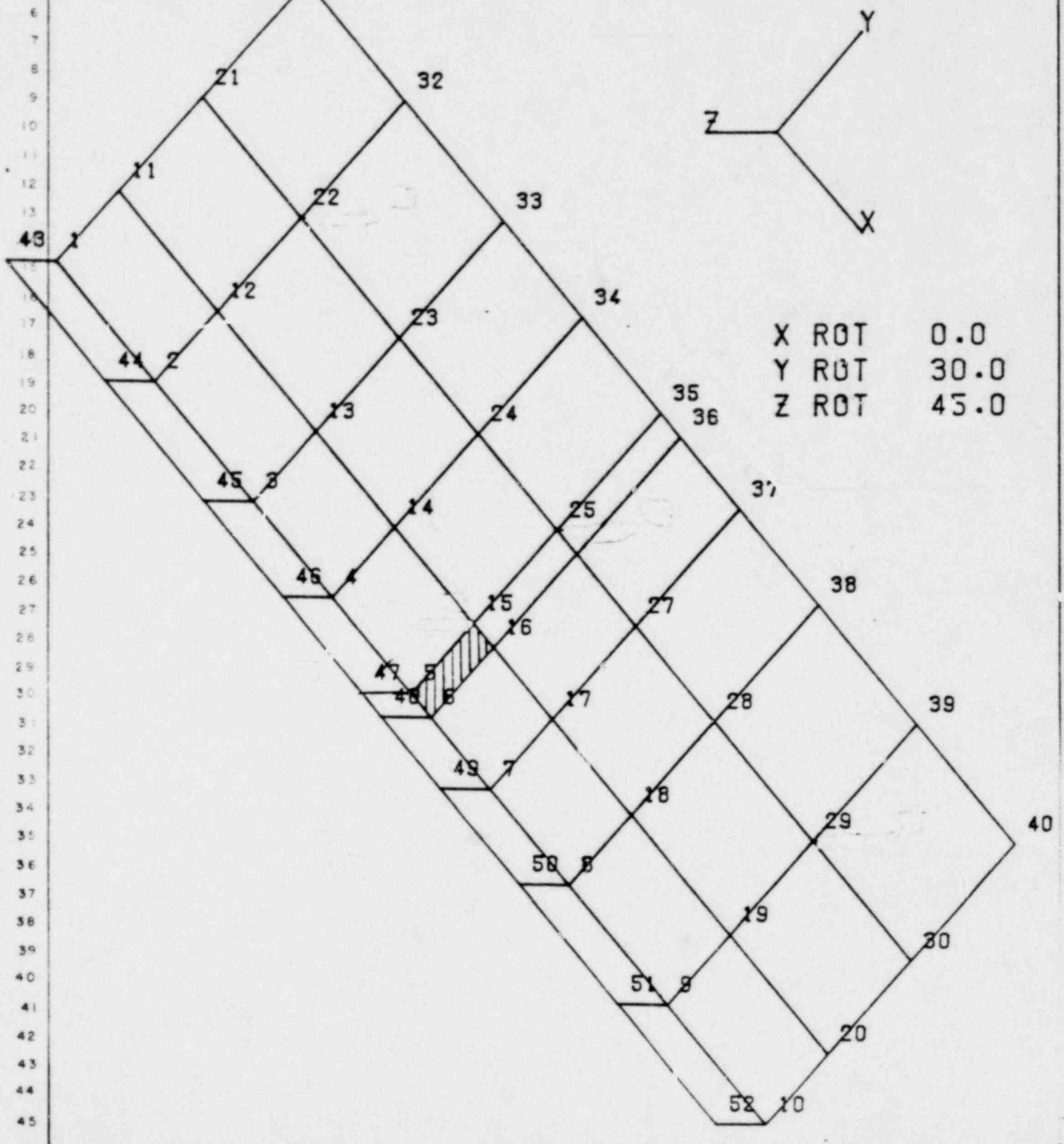
CALCULATION SHEET

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 3
11600.02	EMD			

WALL-MOUNTED INST. STD W/IC 61# PT006

"STRUDL" MODEL



X ROT 0.0
Y ROT 30.0
Z ROT 45.0

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

7010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 4
11600.02	EMD			

WALL-MOUNTED INST. STAND W/1C61*PT006

"STRUDL" INPUT

```
//*7966025 JOB 8B,TUNG------,  11600.02  LILCO
// MSGLEVEL=1
/*JOBINFO R=360K,T=5,X=0125,CALL=N
/*PLOTS PEN=.3MM,INK=CARBON,PAPER=11 INCH,VELLUM,TIME=4 MIN
// EXEC STRUDL,TIME=2,PRINT=A,REGION=360K
STRUDL 'DYNAMIC' 'INST STD W/1C61*PT006 NSSS-4 EL 79' MESSAGE 'OFF'
UNIT INCH LBS SEC
JOINT COORDINATES
1 0. 0. & 2 5. 0. & 3 10. 0. & 4 14. 0. & 5 18. 0. S
6 19. 0. S & 7 22. 0. & 8 26. 0. & 9 31. 0. & 10 36. 0.
11 0. 3. & 12 5. 3. & 13 10. 3. & 14 14. 3. & 15 18. 3. S
16 19. 3. S & 17 22. 3. & 18 26. 3. & 19 31. 3. & 20 36. 3.
21 0. 7. & 22 5. 7. & 23 10. 7. & 24 14. 7. & 25 18. 7.
26 19. 7.  & 27 22. 7. & 28 26. 7. & 29 31. 7. & 30 36. 7.
31 0. 12. & 32 5. 12. & 33 10. 12. & 34 14. 12. & 35 18. 12.
36 19. 12. & 37 22. 12. & 38 26. 12. & 39 31. 12. & 40 36. 12.
43 0. 0. 3. & 44 5. 0. 3. & 45 10. 0. 3.
46 14. 0. 3. & 47 18. 0. 3. & 48 19. 0. 3. & 49 22. 0. 3.
50 26. 0. 3. & 51 31. 0. 3. & 52 36. 0. 3.
TYPE PLATE BENDING   $ 12"X36"X1/4" PLATE
ELEM INCIDENCES
1 1 2 12 11 & 2 2 3 13 12 & 3 3 4 14    & 4 4 5 15 14 & 6 6 7 17 16
7 7 8 18 17 & 8 8 9 19 18 & 9 9 10 2     & 10 11 12 22 21 & 11 12 13 23 22
12 13 14 24 23 & 13 14 15 25 24 & 14     & 26 26 25 & 15 16 17 27 26
16 17 18 28 27 & 17 18 19 29 28 & 18 19 20 30 29 & 19 21 22 32 31
20 22 23 33 32 & 21 23 24 34 33 & 22 24 25 35 34 & 23 25 26 36 35
24 26 27 37 36 & 25 27 28 38 37 & 26 28 29 39 38 & 27 29 30 40 39
5 5 6 16 15
29 1 43 44 2 & 30 2 44 45 3 & 31 3 45 46 4
32 4 46 47 5 & 33 5 47 48 6 & 34 6 48 49 7
35 7 49 50 8 & 36 8 50 51 9 & 37 9 51 52 10
MEM PROP
ELEM 1 TO 9 PROP TYPE 'BPR' THI 0.5
ELEM 10 TO 27 PROP TYPE 'BPR' THI 0.25
ELEM 29 TO 37 PROP TYPE 'PSR' THI 0.25
CONSTANTS
E 30.0E6 ALL & DEN .283 ALL
POIS .30 ALL
INERTIA LUMPED
INERTIA OF NOD ADD 22 25 LIN ALL 0.026  $ 2 PRESS TRANS 10 LBS EA
INERTIA OF NOD ADD 29 LIN ALL 0.0233   $ PRESS TRANS 9 LBS

DRAW JOINT ANNOT ROT 0. 30. 45. PIVOT 1 SIZE 8 FINISH

DYN ANAL MODAL 20

LIST DYN EIGENVALUES EIGENVECTORS 10
FINISH
/*
```

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 5
11600.02	EMD			

STRUDL OUTPUT

****
RESULTS OF LATEST ANALYSES
****

PROBLEM - DYNAMIC TITLE - INST STD W/1C61*PT006 NSSS-4 EL 79

ACTIVE UNITS INCH LB RAD DEGF SEC

ACTIVE STRUCTURE TYPE PLATE BENDING

ACTIVE COORDINATE AXES X Y

EIGENVALUES

MODE	EIGENVALUE	CIRCULAR FREQUENCY (ANGULAR UNIT/TIME UNIT)	FREQUENCY (CYCLES/TIME UNIT)	PERIOD (TIME UNIT/CYCLE)
1	6.445028D 04	2.538706D 02	4.040476D 01	2.474956D-02
2	7.673869D 04	2.770175D 02	4.408870D 01	2.268155D-02
3	3.882972D 05	6.231350D 02	9.917501D 01	1.008318D-02
4	7.512456D 05	8.667442D 02	1.379466D 02	7.249180D-03
5	1.297131D 06	1.138917D 03	1.812642D 02	5.516808D-03
6	1.350921D 06	1.162291D 03	1.849844D 02	5.405861D-03
7	1.799471D 06	1.341444D 03	2.134974D 02	4.683898D-03
8	2.208443D 06	1.486083D 03	2.365175D 02	4.228017D-03
9	2.925039D 06	1.710275D 03	2.721987D 02	3.673787D-03
10	4.333913D 06	2.081805D 03	3.313296D 02	3.018143D-03
11	4.620857D 06	2.149618D 03	3.421223D 02	2.922931D-03
12	7.079780D 06	2.660786D 03	4.234772D 02	2.361402D-03
13	7.526405D 06	2.743429D 03	4.366304D 02	2.290267D-03
14	8.351715D 06	2.889933D 03	4.599472D 02	2.174163D-03
15	9.693557D 06	3.113448D 03	4.955206D 02	2.018080D-03
16	1.187700D 07	3.446302D 03	5.484960D 02	1.823167D-03
17	1.714542D 07	4.140702D 03	6.590133D 02	1.517420D-03
18	2.429423D 07	4.928918D 03	7.844616D 02	1.274760D-03
19	2.703700D 07	5.199712D 03	8.275599D 02	1.208372D-03
20	2.808333D 07	5.299371D 03	8.434210D 02	1.185647D-03

EIGENVECTORS

MODE 1

JOINT	DISPLACEMENT			ROTATION		
	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.

▲ 5010.55

CALCULATION IDENTIFICATION NUMBER				PAGE 6
J.O. OR W.O. NO. 11600.02	DIVISION & GROUP EMD	CALCULATION NO.	OPTIONAL TASK CODE	

STRUDL OUTPUT (CONT'D)

1	GLOBAL	-0.0056543	0.0974088	0.0615956	0.0057069
2	GLOBAL	-0.0053641	0.0649815	0.0526585	0.0064397
3	GLOBAL	-0.0043135	0.0345237	0.0340601	0.0056687
4	GLOBAL	-0.0022292	0.0141356	0.0142903	0.0062086
5	GLOBAL	0.0	0.0	0.0	0.0
6	GLOBAL	0.0	0.0	0.0	0.0
7	GLOBAL	-0.0001806	-0.0085198	0.0000276	0.0036222
8	GLOBAL	-0.0006316	-0.0203918	-0.0023201	0.0030268
9	GLOBAL	-0.0008354	-0.0362837	-0.0049219	0.0032659
10	GLOBAL	-0.0008944	-0.0525620	-0.0063817	0.0031518
11	GLOBAL		0.2845288	0.0636792	0.0104028
12	GLOBAL		0.2247671	0.0545820	0.0147780
13	GLOBAL		0.1378799	0.0352441	0.0190445
14	GLOBAL		0.0576963	0.0152521	0.0199940
15	GLOBAL		0.0	0.0	0.0
16	GLOBAL		0.0	0.0	0.0
17	GLOBAL		-0.0078250	0.0006943	0.0043558
18	GLOBAL		-0.0272487	-0.0022720	0.0048802
19	GLOBAL		-0.0512140	-0.0050916	0.0045176
20	GLOBAL		-0.0720281	-0.0066793	0.0039585
21	GLOBAL		0.5875574	0.0819791	0.0168361
22	GLOBAL		0.4838114	0.0687608	0.0276199
23	GLOBAL		0.3123437	0.0500298	0.0373796
24	GLOBAL		0.1695586	0.0366121	0.0323539
25	GLOBAL		0.0654233	0.0240436	0.0202258
26	GLOBAL		0.0473283	0.0194675	0.0163098
27	GLOBAL		0.0086243	0.0083693	0.0109811
28	GLOBAL		-0.0314915	0.0004649	0.0093324
29	GLOBAL		-0.0734941	-0.0051586	0.0071338
30	GLOBAL		-0.1045126	-0.0084569	0.0057298
31	GLOBAL		1.0000000	0.0828090	0.0316001
32	GLOBAL		0.8248747	0.0695627	0.0420848
33	GLOBAL		0.5779411	0.0546586	0.0537594
34	GLOBAL		0.3669788	0.0399052	0.0495386
35	GLOBAL		0.1905754	0.0247120	0.0377750
36	GLOBAL		0.1541998	0.0210899	0.0348260
37	GLOBAL		0.0632996	0.0110741	0.0258678
38	GLOBAL		-0.0226484	0.0019181	0.0178220
39	GLOBAL		-0.0951976	-0.0043079	0.0116266
40	GLOBAL		-0.1441111	-0.0076612	0.0089988
43	GLOBAL	0.0138775	0.0973536		
44	GLOBAL	0.0136199	0.0649711		
45	GLOBAL	0.0125794	0.0345130		
46	GLOBAL	0.0105315	0.0140540		
47	GLOBAL	0.0078905	0.0011090		
48	GLOBAL	0.0076970	-0.0012475		
49	GLOBAL	0.0082186	-0.0084069		
50	GLOBAL	0.0086293	-0.0204027		
51	GLOBAL	0.0088369	-0.0362796		
52	GLOBAL	0.0088889	-0.0525521		

MODE 2

JOINT		DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
1	GLOBAL	-0.0003858		-0.0308743	0.0089105	-0.0017382	

▲ 5010.85

CALCULATION IDENTIFICATION NUMBER				PAGE 7
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
11600.02	EMD			

STRUDL OUTPUT (CONT'D)

2	GLOBAL	-0.0003724	-0.0226632	0.0080795	-0.0016672
3	GLOBAL	-0.0003107	-0.0143372	0.0059050	-0.0016003
4	GLOBAL	-0.0002560	-0.0075628	0.0032169	-0.0020242
5	GLOBAL	0.0	0.0	0.0	0.0
6	GLOBAL	0.0	0.0	0.0	0.0
7	GLOBAL	0.0019213	0.0077447	0.0101108	-0.0046201
8	GLOBAL	0.0040241	0.0242688	0.0310994	-0.0049487
9	GLOBAL	0.0051469	0.0501005	0.0513754	-0.0054995
10	GLOBAL	0.0054545	0.0780334	0.0610879	-0.0047509
11	GLOBAL		-0.0038575	0.0091549	-0.0013485
12	GLOBAL		0.0018851	0.0084135	-0.0007767
13	GLOBAL		0.0037762	0.0062598	-0.0000318
14	GLOBAL		0.0029759	0.0042086	0.0005024
15	GLOBAL		0.0	0.0	0.0
16	GLOBAL		0.0	0.0	0.0
17	GLOBAL		0.0389333	0.0112952	-0.0190590
18	GLOBAL		0.1189789	0.0325572	-0.0193261
19	GLOBAL		0.2062455	0.0535136	-0.0145858
20	GLOBAL		0.2638711	0.0633948	-0.0098344
21	GLOBAL		0.0397725	0.0122680	-0.0014781
22	GLOBAL		0.0444544	0.0122041	-0.0001258
23	GLOBAL		0.0429113	0.0130576	0.0001940
24	GLOBAL		0.0462756	0.0172431	-0.0024623
25	GLOBAL		0.0713297	0.0288410	-0.0118950
26	GLOBAL		0.0856324	0.0325400	-0.0170982
27	GLOBAL		0.1543282	0.0404015	-0.0293110
28	GLOBAL		0.2926361	0.0519823	-0.0375564
29	GLOBAL		0.4673402	0.0705428	-0.0282478
30	GLOBAL		0.5721925	0.0844437	-0.0167104
31	GLOBAL		0.1049213	0.0134211	-0.0009975
32	GLOBAL		0.1094365	0.0134276	-0.0009382
33	GLOBAL		0.1190096	0.0158271	-0.0040165
34	GLOBAL		0.1500534	0.0212105	-0.0127386
35	GLOBAL		0.2295830	0.0314881	-0.0278205
36	GLOBAL		0.2594925	0.0346138	-0.0318346
37	GLOBAL		0.3748740	0.0445497	-0.0443495
38	GLOBAL		0.5735856	0.0579565	-0.0526103
39	GLOBAL		0.8211749	0.0724992	-0.0428353
40	GLOBAL		1.0000000	0.0862147	-0.0322782
43	GLOBAL	-0.0053109	-0.0308792		
44	GLOBAL	-0.0053237	-0.0226594		
45	GLOBAL	-0.0053749	-0.0143612		
46	GLOBAL	-0.0054815	-0.0074080		
47	GLOBAL	-0.0054729	-0.0008145		
48	GLOBAL	-0.0056878	0.0008448		
49	GLOBAL	-0.0078834	0.0078126		
50	GLOBAL	-0.0100042	0.0242446		
51	GLOBAL	-0.0111108	0.0500917		
52	GLOBAL	-0.0113844	0.0779740		

MODE 3

JOINT		DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
1	GLOBAL	0.0110972		-0.1070617	-0.0269481	-0.0075015	
2	GLOBAL	0.0104450		-0.0669423	-0.0130990	-0.0082260	

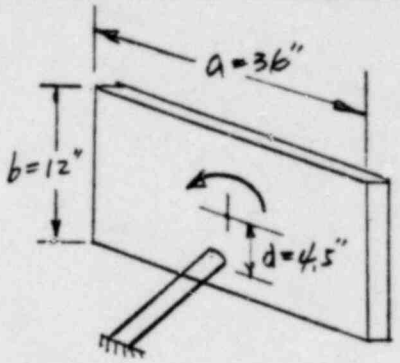
▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				PAGE 8
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
11600.02	EMD			

STRUDL OUTPUT (CONT'D)

3	GLOBAL	0.0083137	-0.0311202	0.0035902	-0.0069429
4	GLOBAL	0.0047619	-0.0103175	0.0064517	-0.0030246
5	GLOBAL	0.0	0.0	0.0	0.0
6	GLOBAL	0.0	0.0	0.0	0.0
7	GLOBAL	-0.0040212	-0.0041255	0.0016615	0.0015368
8	GLOBAL	-0.0073086	-0.0187201	-0.0009647	0.0051566
9	GLOBAL	-0.0092804	-0.0459627	-0.0162226	0.0064736
10	GLOBAL	-0.0098887	-0.0772182	-0.0293225	0.0057720
11	GLOBAL		-0.1903749	-0.0293655	-0.0156512
12	GLOBAL		-0.1061723	-0.0131022	-0.0182083
13	GLOBAL		-0.0159661	0.0075708	-0.0145935
14	GLOBAL		0.0184954	0.0161579	-0.0004460
15	GLOBAL		0.0	0.0	0.0
16	GLOBAL		0.0	0.0	0.0
17	GLOBAL		0.0092804	0.0104576	-0.0001648
18	GLOBAL		-0.0170941	0.0031898	0.0120438
19	GLOBAL		-0.0944617	-0.0161237	0.0157941
20	GLOBAL		-0.1675591	-0.0316570	0.0135115
21	GLOBAL		-0.3412291	-0.0326277	-0.0418499
22	GLOBAL		-0.1277403	0.0089689	-0.0481979
23	GLOBAL		0.1283783	0.0603882	-0.0475464
24	GLOBAL		0.2820691	0.1006741	-0.0303169
25	GLOBAL		0.3483356	0.1255347	0.0061519
26	GLOBAL		0.3364345	0.1237857	0.0160014
27	GLOBAL		0.2631186	0.1000744	0.0305620
28	GLOBAL		0.1132270	0.0576188	0.0451797
29	GLOBAL		-0.1266789	0.0059878	0.0450037
30	GLOBAL		-0.3269038	-0.0349976	0.0393116
31	GLOBAL		-0.4351472	-0.0117306	-0.0831643
32	GLOBAL		-0.0005652	0.0316731	-0.0968132
33	GLOBAL		0.5185736	0.0883800	-0.1013721
34	GLOBAL		0.8668876	0.1294574	-0.0650668
35	GLOBAL		1.0000000	0.1414176	0.0004176
36	GLOBAL		0.9893537	0.1420208	0.0213160
37	GLOBAL		0.8466154	0.1288904	0.0704316
38	GLOBAL		0.4896182	0.0851845	0.1009464
39	GLOBAL		-0.0182626	0.0275368	0.0935704
40	GLOBAL		-0.4357859	-0.0150557	0.0797174
43	GLOBAL	-0.0131426	-0.1069376		
44	GLOBAL	-0.0125588	-0.0669293		
45	GLOBAL	-0.0104064	-0.0311740		
46	GLOBAL	-0.0068948	-0.0101611		
47	GLOBAL	-0.0019589	-0.0005985		
48	GLOBAL	-0.0008225	-0.0001998		
49	GLOBAL	0.0032277	-0.0040236		
50	GLOBAL	0.0064882	-0.0187556		
51	GLOBAL	0.0084738	-0.0459554		
52	GLOBAL	0.0090187	-0.0770988		

NATURAL FREQUENCY IN ROTIONAL DIRECTION ABOUT THE PIPE AXIS



$$f = \frac{1}{2\pi}\sqrt{\frac{k}{J}}$$

$$k = \frac{\pi}{32L}(d_o^4 - d_c^4)\,G$$

2" SCH XS PIPE

$d_o = 2.375"$, $d_i = 1.939"$

L = LENGTH OF PIPE = 7.75"

$$G = \frac{E}{2(1+\mu)} = \frac{30\times10^6}{2(1+0.3)} = 11.5\times10^6\ lb/in^2$$

$$k = \frac{\pi}{32\times7.75}(2.375^4 - 1.939^4)\times11.5\times10^6 = 2.576\times10^6\ lb\text{-}in/rad$$

J = INERTIA

$= J_o + md^2$, $d = 4.5"$

$$J_o = \frac{1}{12}[a^2+b^2]\,m$$

$a = 36"$, $b = 12"$

m = mass of PLATE, ANGLE, AND INSTRUMENTS

$$= [0.283\times12\times36\times1/4 + 3'\times4.9\ lb/ft + (10+10+9)lbs]/386$$

$$= [30.564 + 14.7 + 29]/386$$

$$= 74.264/386 = 0.192\ SLUGS$$

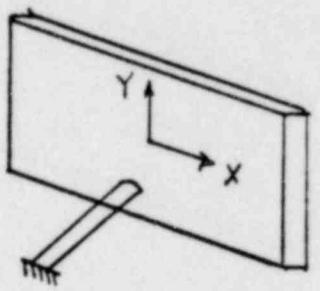
$$\therefore J = \left[\frac{1}{12}(12^2+36^2) + 4.5^2\right]\times0.192 = 26.928$$

$$\therefore f = \frac{1}{2\pi}\sqrt{\frac{2.576\times10^6}{26.928}} = \underline{49.23\ Hz.}$$

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 10
11600.02	EMD			

NATURAL FREQUENCY IN IN-PLANE (X AND Y) DIRECTION



$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

CANTILEVER BEAM

$$f = \frac{1}{2\pi}\sqrt{\frac{3EI}{mL^3}}$$

$E = 30 \times 10^6$ lb/in^2

$I = 0.87$ in^4 (2" SCH. XS PIPE)

$L = 7.75$"

m = mass of PLATE AND ANGLE AND INST.

$= 0.283 \times 12 \times 36 \times 1/4 + 4.9 \times 3]/386 + 29/386$

$= [30.564 + 14.7]/386 + 29/386$

$= 45.264/386 + 29/386$

$= 0.192$ SLUGS

$$f = \frac{1}{2\pi}\sqrt{\frac{3 \times 30 \times 10^6 \times 0.87}{0.192 \times 7.75^3}} = \underline{149 \text{ Hz.}}$$

ENCLOSURE 2

Change pages to SNRC-564

Attachment II - pages 2, 7 and 8

Attachment III - 1 page for Item 4
3 pages for Item 19
3 pages for Item A5

Long Island Lighting Company
Stone and Webster - AE
General Electric - NSSS

Item 1: 1H11*PNL-613 (H11P613)

a) Provide the revision of a report.

b) Revise the SQRT form.

RESPONSE:

a) Revision 1 dated May 6, 1981 of General Electric Report DRF No. A00-992 summarizing the qualification of control room and local panels is provided in Attachment V behind Tabs 1 and 2 respectively.

b) The SQRT form has been revised as requested during the review at the Site, and included under Tab 1 of Attachment III.

Item 2: 1H21*PNL-10 (H21P010)

a) Revise the SQRT form, particularly to show welding description.

RESPONSE

a) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 2 of Attachment III.

Item 3: 1H21*PNL-36 (H21P036)

a) Revise the SQRT form.

RESPONSE:

a) The SQRT forms has been revised as requested during the review at the Site, and is submitted under Tab 3 of Attachment III.

Item 4: 1C61*PT006 (C61N006)

a) Provide a calculation of support frame frequency by Stone & Webster.

RESPONSE:

a) A dynamic analysis was conducted to determine the support frame frequency of this stand with instruments attached, and is provided in Enclosure 1 to LLLO letter SNRC-575. Results demonstrate a fundamental frequency of 40 Hz which is above the 5 Hz requirement to limit the dynamic loads on the mounted instruments to less than or equal to 2 g horizontal and 1.5 g vertical.

b) A pipe stress analysis based on the design configuration has been conducted on this 10 in. line, using the revised model of this operator referenced in (a) above. Results show 2.9 horizontal and 3.0 g's vertical accelerations acting at the operator center-of-gravity from combined seismic and hydrodyamic load. Confirmation of the limiting acceleration (g) values for the as-built configuration will be provided after their as-built piping review is completed, as indicated in Item 5 of Attachment I.

c) The vendor designed this operator to 3.0 g's horizontal and vertical accelerations acting at the center of gravity of the operator with a 1.3 minimum factor of safety on stress. Since these accelerations including the factor of safety are above the required accelerations noted in (b) above, the adequacy of the actuator to withstand combined seismic and hydrodynamic loads is established.

d) No additional information of operability testing of this actuator is available. As shown in the vendor's report, the relative displacement between actuator stem and valve frame is 28 mils. Since the clearance provided is 111 mils, operability is assured for a combined seismic and hydrodynamic environment.

e) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 18 of Attachment III.

f) Information concerning the support of instrument lines is provided in Item (3) of Attachment I.

Item 19: 1R23*T-102

a) Provide the mounting configuration (which could not be inspected during the visit due to the integrated flush activities).

b) Revise the SQRT form, particularly to note the frequencies of the several components.

RESPONSE:

a) The mounting information will be added to the SQRT form after its deenergization makes it accessible for inspection.

b) With the exception identified in (a) above, the SQRT form has been revised as requested during the review at the Site including the frequency range, and is submitted under Tab 19 of Attachment III. As discussed in Item 12(e), the frequency of any components is not measured in a multi-frequency test.

Item 20: 1M50*PNL-04

a) Revise the SQRT form, particularly to indicate the weight and the frequency range.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, including the weight and the frequency range covered by the test, and is submitted under Tab 20 of Attachment III.

Item 21: 1H11-PNL-SNP

This item was dropped because it is not safety-related.

Additional Item 2: 1B21*PS020 (B21N015)

a) Provide information by Stone & Webster concerning the support of small tubing.

RESPONSE:

a) This information is provided in Item (3) of Attachment I.

Additional Item 5: 1C11*LS095 (C11N013)

a) Provide an evaluation of the safety significance of contact chatter.

RESPONSE:

a) The test results for this pipe-mounted level switch show malfunction (onset of chatter) limits of 1. 2 g's horizontal and 9.5 vertical for frequencies below 30 Hz. Additional testing above 30 Hz showed an anomaly at 50 Hz where the onset of chatter began at 0.26 g. The piping analysis gives accelerations including all modal contributions equal to 1.0 g's horizontal and .8 g's vertical, as shown by an SRSS of modal accelerations. The contribution above 30Hz is less than .1g. Hence, this evaluation demonstrates that the level switch can withstand the Shoreham dynamic environment from combined seismic and hydrodynamic loads, without reaching unacceptable chatter.

Additional Items 6 and 7: 1E51*RV145 and 1E51*RV149

a) Revise SQRT form, particularly to indicate the natural frequency of the internal components.

b) Either confirm that no chatter occurs or provide an evaluation of the safety significance of chatter.

c) Correct the drawing to show the actual set pressure.

QUALIFICATION SUMMARY AND EVALUATION

1. Component Name Pressure Transmitter

2. Mark Numbers 1C61*PT-006 (1C61N006)

3. Qualification Documentation

A. Qualification Summary of Equipment (SQRT form), including required response spectra if applicable.

Enclosed

B. Reference Documents in the Central File Package

Reference Number	Document Identification	Revision or Date	Organization/Title/Subject
(1)	DV163C1186,#440	3/3/72	GE Design Record File
(2)	11600.02-NM(B)-237	1/30/80	SH1-343 Instrument Stands

C. Additional Supporting Documents not in the Central File Package

Document ID No.	Revision or Date	Organization/Title/Subject
SNRC-535	March 5, 1981	LILCO Seismic Qualification Review - response to Request for Additional Information, Response 271.4
1C61N006		Design Specification

4. Shoreham Requirements (dynamic loads, functional requirements)

The pressure transmitter is part of the reactor plant remote shut down system and measures P.D. for remote indication of RPV water level during the hot standby and cold shut down conditions. It must be capable of operation before, during and after a combination of hydrodynamic loads and seismic faulted loads of 2 g horizontal and 1.5g vertical. (Ref 3.B.2).

5. Demonstrated Capability (from qualification report)

The qualification test report (Ref 3.B.1) shows that the pressure transmitter performs its intended function before, during and after exposure to the required seismic loads and demonstrates an adequate margin of capability by performing its required functions up to the following (fragility) seismic loads: 5.5g horizontal and 3.7g vertical.

6. Rationale for Qualification

a. Approach (analysis, test, both)

The 480-4160V Transformer Bus 1 was subjected to simultaneous horizontal and vertical inputs of phase coherent random multi-frequency motion in the FB/V and SS/V directions. The amplitude of each frequency was adjusted through the use of a waveform synthesizer until the test response spectrum enveloped the required response spectrum over the frequency range of the 1 Hz. to 100 Hz.

b. Response to Loads (including high-frequency considerations)

As noted in Ref. 3.B.2, Section R-09402, page 4, the 480-4160V Transformer Bus 1 demonstrated sufficient structural integrity to withstand the prescribed random multi-frequency test. The results of the frequency sweep tests identified the predominant natural frequencies in the orthogonal directions to be (Ref. 3.B.2, Section R-09402, page 4), 5.5 Hz for FB/V excitation and 8.5 Hz for SS/V excitation.

c. Operability

The 480-4160V Transformer Bus 1 was monitored during the test to determine electrical operability. In addition, a hi-pot test of 1 minute at 8 milliamperes and a megohmet test at 500 V DC were performed before and after the seismic test. The tests demonstrated that the electrical function of the 480-4160V Transformer Bus 1 was not compromised as noted in Ref. 3.B.2, Section R-09402, page 4.

d. Field vs Qualification Mounting

It is presumed that the field mounting is comparable to the qualification mounting. Verification will be made when this unit is accessible for inspection (DEENERGIZED).

Reviewer's Conclusions

It is concluded that the tests performed on the 480-4160V Transformer Bus 1 satisfy and successfully meet the requirements for the Shoreham Nuclear Power Station, Unit #1. There were no structural, mechanical, or electrical failures detected during the random multi-frequency tests.

SH1-95

Item ( )

QUALIFICATION SUMMARY OF EQUIPMENT

I. Plant Name: SHOREHAM Type:

1. Utility: LILCO PWR _____

2. NSSS: GE 3. A/E: Stone & Webster BWR 4 MKII

II. Component Name: 4160-480V Transformer Bus 1

1. Scope: [ ] NSSS [X] BOP

2. Vendor and Model Number: ITE Imperial Corp, Type VU-9 Quantity: 3

3. S/W Mark Nos: 1R23*T-102, -101, -103

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Enclosed in cabinet (floor mounted) Cabinet

b. Dimensions 58"Dx78" Lgx90"H c. Weight 3,900 lbs. (Transformer Section Only)

6. Location: Building CB Elevation 25 ft.

7. Field Mounting Conditions [ ] Bolt (No. ____ , Size _____)

[ ] Weld (Length ____)

[X] Not available for inspection until deenergized.

8. a. System in which located: 480 V Emergency Power

b. Functional Description: Control Circuits for Station Emergency 480 V Power

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither

9. Pertinent Reference Design Specifications: SH1-95

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [XX] Multi-Frequency [X]random [ ]sine beat [ ]_____

2. [ ] Single Axis [XX] Multi-Axis

3. No. of Qualification Tests: Upset ≥5 Faulted ≥1 Other _____ (specify)

4. Frequency Range: 1 - 50 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ≥5.5 Hz F/B = ≥5.5 Hz V = 5.5 Hz

6. Method of Determining Natural Frequencies

[XX] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [XX] Yes (Attach TRS and RRS graphs)

[ ] No

8. Input g-level Test: Upset S/S = _____ F/B = _____ V = _____

Faulted S/S = 2.4 F/B = 2.4 V = 2.4

9. Laboratory Mounting:

[XX] Bolt (No. 4, Size 3/4") [ ] Weld (Length _____)[ ]_____

10. Functional operability verified: [XX] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Meets the Spec requirements without modification

12. Other test performed (such as aging or fragility test, including results):

None

*NOTE: If qualification by a combination of test and analysis, also complete Item VII.

QUALIFICATION SUMMARY AND EVALUATION

1. Component Name Level Switch

2. Mark Numbers 1C11*LS-095 (C11NC13)

3. Qualification Documentation

A. Qualification Summary of Equipment (SQRT form), including required response spectra if applicable.

Enclosed

B. Reference Documents in the Central File Package

Reference Number	Document Identification	Revision or Date	Organization/Title/Subject
1	DV159C4361	11/25/80	GE Design Record File
2	11600.02-AX-12U-1		S&W Pipe Stress Summary

C. Additional Supporting Documents not in the Central File Package

Document ID No.	Revision or Date	Organization/Title/Subject
SNRC-535	March 5, 1981	LILCO Seismic Qualification Review - response to Request for Additional Information, Response 271.4

4. Shoreham Requirements (dynamic loads, functional requirements)

The level switch is part of the control rod drive system and its function is to scram the reactor during power operation on high water level. It must be capable of operation before, during and after a combination of hydrodynamic and seismic faulted loads of 1.0 g horizontal and .8 g vertical (ref 3.B.2) over the frequency range of 1-30 Hz. Above 30 Hz, based on the reference 2 pipe stress analysis, the required accelerations are less than 0.1 g's.

5. Demonstrated Capability (from qualification report)

The qualification test report (ref 3.B.1) shows that the level switch performs its intended function before, during, and after exposure to the required seismic loads and demonstrates an adequate margin of capability by performing its required functions up to the following (fragility) dynamic loads: 1.2 g horizontal and 9.5 g vertical accelerations between 4 and 30 Hz. A scan test showed no resonances below 60 Hz. A separate test was run between 30 and 1000 Hz to establish malfunction limits in the high-frequency range. At 50 Hz, the limit dropped to .26 g's due to contact chatter.

6. Rationale for Qualification

a. Approach (analysis, test, both)

The level switch was qualified by subjecting it to single axis, single frequency vibration tests over a frequency range of 4-1000 Hz. (Front to back, side to side, and vertical).

b. Response to Loads (including high-frequency considerations)

The level switch showed no structural degradation during and after testing.

c. Operability

The specification requirements were met during and after exposure to the required dynamic loads which demonstrates that the level switch can withstand the Shoreham dynamic environment from combined seismic and hydrodynamic loads.

d. Field vs Qualification Mounting

Qualification mounting was the same as the field mounting. (Pipe-Mounted)

Reviewer's Conclusions

Based on GE qualification report (ref 3.B.1), This reviewer concludes that the level switch can perform its required functions in the presence of the hydrodynamic and seismic loads imposed by service in the Shoreham Nuclear Power Station Unit 1.

VI. If Qualification by Test, then Complete*:

1. [X] Single Frequency [ ] Multi-Frequency [ ] random [ ] sine beat [ ] _____

2. [X] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: Upset _____ Faulted ___ Other 1-Fragility (specify)

4. Frequency Range: 4-1000 Hz _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 60 HZ F/B = > 60 HZ V = > 60HZ

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS and RRS graphs)

N/A [ ] No

8. Input g-level Test: Upset S/S = 2.0 F/B = 1.2 V = 9.5
(4-30 Hz)

Faulted S/S = 2.0 F/B = 1.2 V = 9.5

(30-1000 Hz test showed anomaly at 50 Hz where limit dropped to .26 g).

9. Laboratory Mounting:

[ ] Bolt (No. _____, Size _____) [ ] Weld (Length _____) [X] Threaded Pipe

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Meets spec. without modification

12. Other test performed (such as aging or fragility test, including results):

Fragility - same as Item VI .8

*NOTE: If qualification by a combination of test and analysis, also complete Item VII.