LONG ISLAND LIGHTING COMPANY

175 EAST OLD COUNTRY ROAD · HICKSVILLE, NEW YORK 11801

ANDREW W. WOFFORD
VICE PRESIDENT

SNRC-50

June 3, 1975

Mr. J. F. Stolz, Chief
Light Water Reactors Branch 2-1
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

BWR Mark II Containment
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Dear Mr. Stolz:

In accordance with our letter of May 15, 1975, we hereby submit the schedule and program (Attachment A) for analyzing and resolving the effects of LOCA related suppression pool hydrodynamic loads, safety relief valve vent clearing and steam quenching phenomena. This schedule has been coordinated with the General Electric Company and other utilities building Mark II containments.

We view the specific loads identified in your letters of April 18 and April 21, 1975, as possibly inter-related, and we intend to analyze them concurrently. Much of the information presently available on these loads is related to other containment designs, and cannot be readily extrapolated to the Mark II containment. The initial assessment of the Shoreham containment must, therefore, await a determination of the time history sequence of the various phenomena, the forcing functions which result, and the relationship of these functions to each other and to the specific geometry of our containment structures and components. Preliminary Mark II time histories, forcing functions based on available data, and the methods for relating these to the Mark II containment are being developed now and will be available in September as the "Preliminary Forcing Function

Mr. J. F. Stolz

Report". This will then permit the preliminary containment assessment to proceed, and we expect the results of this assessment to be available in November, 1975.

Certain tests and mathematical models will be helpful in verifying the preliminary assessment. Although some of this effort can be identified now, the Preliminary Forcing Function Report and the initial containment assessment may reveal additional testing and modeling requirements. A complete schedule would not, therefore, be feasible until December, 1975. Once the test program has been defined and scheduled, we will establish and submit a schedule for the final assessment of our containment design.

Construction of the suppression pool structures, including the foundation mat, walls, liner, drywell floor, and reactor support pedestal is essentially complete. Although some minor modifications may be required to mitigate the consequences of the subject phenomena, we feel that the need for major structural modifications is exceedingly remote.

Very truly yours,

A. W. Wofford
Vice President

ATTACHMENT "A"
MARK II SCHEDULE & PROGRAM

	Program	Schedule	LOCA Questions	SRV Questions
1.	Submit plant unique suppression pool and relief valve drawings reflecting current design.	July, 1975	1	1,5*
2.	Submit a generic "Preliminary Forcing Function Report" which will provide the time history of pool dynamic forcing functions and the methods for relating these functions to the containment structures and components.	Sept., 1975	2,7*	1*,2,4*,6
3.	Submit a description of suppression pool temperature monitoring system. (Temperature limits and transients will be described in the Final Safety Analysis Report.)	Oct., 1975	Not Appl.	7,8,9,10
4.	Submit a plant unique preliminary assessment of containment structures and components based on the Preliminary Forcing Function Report.	Nov., 1975	3,4,5,6,7*,8	3,4*,5

* Partial Answer

MASTER

ATTACHMENT "A"
MARK II SCHEDULE & PROGRAM

Program	Schedule	LOCA Questions	SRC Questions
5. Submit a schedule for the generic test program and mathematical models which justify the forcing functions used to assess containment structures and components.	Dec., 1975	7	4
6. Submit a schedule for the final assessment of containment structures and components.	First Quarter 1976	-	-

LILCO

LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION

P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

May 29, 1981

SNRC-578

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

Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Dear Mr. Denton:

Forwarded herewith are sixty (60) copies of LILCO's responses to the Safety Evaluation Report (SER) Outstanding Issues listed in Attachment 1.

Please note that our responses to Outstanding Issue Numbers 9, "Environmental Qualification" and #57, "TMI-2 Requirements" have been forwarded to you under separate cover via letters SNRC-576 and SNRC-579 respectively, dated May 29, 1981.

Very truly yours,

C. P. Novarro

C. P. Novarro
Project Manager
Shoreham Nuclear Power Station - Unit 1

CC/pd
Enclosures

cc: J. Higgins

ATTACHMENT 1 - SER OUTSTANDING ISSUES

Number	Issue
20	Appendix G - IV.A.2.a - Nil Ductility Temperature
21	Appendix G - IV.A.2.c - Pressure Temperature Limit
22 *	Appendix G - Impact Testing
23	Appendix G - IV.B - Minimum Upper Shelf Energy
35	Containment Isolation
37	Secondary Containment Bypass Leakage
38 *	Fracture Prevention of Containment Pressure Boundry
51 *	Fracture Toughness of Steam Line and Feedwater Materials
52	Management Organization

* The information provided in this response supplements the information provided in SNRC-566, dated May 15, 1981.

The information contained on the following pages is provided in response to the staff concerns identified as Shoreham SER Outstanding Issues 20, 21, 22, 23, 38 and 52. This data provides an adequate basis for resolution of the staff's concerns.

SHOREHAM REACTOR VESSEL
BELTLINE PLATE AND WELD
INFORMATION

1. Available charpy V-notch and drop-weight NDT data are presented in Tables 1, 2, and 4 for Shoreham beltline plates and welds. Table 2 gives supplementary transverse charpy results which were determined for one of the Shoreham surveillance plates. Table 3 shows a typical test certificate for a Shoreham beltline plate. Table 5 verifies the location of weld materials in beltline weld seams, as well as verifying what data is not available.

2. The beltline layout is shown in Figure 1. This gives plate heat numbers and locatic   s well as weld seam locations and identifications.

3. Copper and phosphorous values, to estimate the effects of radiation on toughness, are presented in Table 6, when available. It can be seen in Table 6 that there are cases for longitudinal weld seams where copper contents are not available. This has been verified as shown in the letter from the vessel vendor (Table 5).

4. Estimated starting (unirradiated) RT_{NDT} values are given in Table 6. They are estimated by using the data in Tables 1 and 4 in accordance with GE procedure Y1006A006 which meets the intent of ASME Code paragraph NB-2300. This procedure is explained in paragraph 5.2.4.3 (Attachment A) of the SNPS-1 FSAR, Rev. 18. The data base for this procedure is further clarified in response to Zimmer (ZPS-1) Q 121.15.

5. Estimated end-of-life (EOL) RT_{NDT} values (for 1/4 thickness location from the vessel inside diameter, as-built dimensions) are given in Table 6. These estimations are in accordance with NRC Regulatory Guide 1.99 Rev. 1. Where Cu content analyses are not available, maximum RT_{NDT} shift (ΔRT_{NDT}) values are conservatively assumed in accordance with Reg. Guide 1.99 Rev. 1. This results in limiting EOL RT_{NDT} values for the longitudinal weld seams in the beltline. Note that the Shoreham vessel surveillance program is designed to represent longitudinal weld seam 1-308 J, although the exact same weld materials were not used. This will be clarified in more detail in the description of the Shoreham surveillance program in this response.

6. Charpy V-notch upper shelf toughness was not a requirement when the Shoreham vessel was manufactured. Thus, such data is not available for the Shoreham beltline welds, but is available for the plates as shown in Tables 1 and 2.

A very conservative assumption of 65% factor on longitudinal upper shelf can be applied to the results of Table 1 in order to estimate transverse orientation upper shelf. (Table 2 shows that an 85% factor may be more accurate than the conservative 65% factor of MTEB5-2). The factor of 65% would result in a longitudinal requirement of 115 ft-lb, in order to meet the 10CFR 50 Appendix G value of 75 ft-lb, transverse upper shelf. This value is met by all plates in Table 1 except C4806-2, which has an average of 107 ft-lb. However, since the Cu content of this plate is only 0.15% (Table 6) a reduction of upper shelf of only 20% is conservatively predicted by Reg. Guide 1.99 Rev. 1. Combining these 2 conservative factors of 65% and 20% results in an initial longitudinal upper shelf value of only 96 ft-lb, to meet the goal of 50 ft-lb. transverse upper shelf at EOL. This value of 96 ft-lb., as calculated in the following equation, is exceeded by plate C4806-2.

$$50 = .65\ (L) - (.20)\ [.65\ (L)\ ]$$

(where L is the longitudinal upper shelf value at start of life)

As seen in Table 4, upper shelf toughness values are not available for Shoreham welds. However, all charpy results at the test temperature of +10° are in excess of the 75 ft-lb, value for the E8018 weld materials. Thus, they should not be a concern. The charpy values for the submerged arc weld materials in Table 4 do not meet the 75 ft-lb. level in 4 cases. However, it is expected that further testing at higher temperatures would have revealed an upper shelf in excess of 75 ft-lb. Evidence in this respect is presented in Tables 7 through 11 which show weld procedures and upper shelf toughness results for similar materials. All upper shelf (~100% shear) results in Tables 8 and 11 are in excess of 75 ft-lb. These welds are considered to be representative of the Shoreham welds since the welding processes (generally tandem wire submerged arc for the bulk of the welds), post weld heat treatment, and weld materials are similar. Particular attention should be given to the LaSalle 1 results, since these welds were made by the same vendor (Combustion Engineering) and with the exact same weld procedure (Table 7) in many cases, as for Shoreham. The material 1P3571/3958 in Table 8 is in both the LaSalle 1 and Shoreham surveillance programs and was prepared by the weld procedure in Table 7, which was used for the Shoreham longitudinal limiting welds. Futher testing of these baseline surveillance specimens gave an upper shelf of 110 ft-lb. as shown in Table 8.

7. Drop-weight NDT values for the Shoreham weld materials were not determined by testing. However, evidence for a conservative assumption of -50°F is found in Table 8, based on the LaSalle 1 results. All values of NDT are -50°F or lower. Futher results in this respect are also shown in Table 11 (CBIN welds) and verify NDT values of -50°F and lower, except for one case. This case (1P6484/0156 for Laquna Verde 2) is considered to be nonrepresentative of Shoreham, because of the relatively low charpy test value (17 ft-lb.) at +10 and 0°F for this material.

SHOREHAM REACTOR VESSEL
NON-BELTLINE INFORMATION

1. Limiting RT_{NDT} values which effect vessel testing and operation are shown in the FSAR (paragraphs shown in Attachment A). The estimation procedures for these RT_{NDT} values are in accordance with GE procedure Y1006A006, and are also explained in the FSAR. As with the beltline, the data base for this procedure is further clarified in response to Zimmer (ZPS-1) Q121.15.

2. A sentence has been added to the FSAR (Attachment A, paragraph 5.2.4.3) to clarify further that these are limiting values for the vessel.

Plate/Heat No.	Drop weight NDT	Orientation LCR T	Charpy Temp	Energy - FT-LBS	Lat. Expansion Mils	% Shear
Lower Intermed. shell C4765-2	-60°F	L	-80°F	9,7	10,9	0,0
			-40°F	25,18,37	25,22,33	10,10,10
			+10°F	48,57,39	41,48,36	10,15,10
			+40°F	57,65,66	49,57,56	25,30,30
			+110°F	110,111	87,86	80,80
			+160°F	144,132	97,94	100,100
C4882-1 (Also in surveillance program)	-60°F	L	-80°F	16,14	15,11	0,0
			-40°F	41,32,54	28,22,38	20,20,25
			+10°F	75,68,48	52,47,35	30,30,25
			+40°F	83,95,100	59,65,70	45,50,60
			+110°F	104,116	75,82	85,90
			+160°F	130,131	86,84	100,100
C4882-2 (Also in surveillance program)	-40°F	L	-80°F	10,7	10,8	0,0
			-40°F	46,43,30	36,35,26	10,10,10
			+10°F	75,50,66	58,44,52	30,20,20
			+40°F	90,80,88	71,62,65	40,35,40
			+110°F	120,107	84,82	85,80
			+160°F	137,129	94,90	100,100
Lower shell C4803-1	-10°F	L	-80°F	14,22	9,17	0,0
			-40°F	30,47,41	23,27,31	10,20,15
			+10°F	61,68,66	50,52,51	35,35,35
			+40°F	79,81,84	57,62,63	50,50,50
			+110°F	112,117	83,88	100,100
			+160°F	121,126	79,87	100,100
C4803-2	-10°F	L	-40°F	13,13	12,11	0,0
			+10°F	56,37,42	47,30,35	30,20,20
			+40°F	50,40,66	42,34,51	40,35,45
			+110°F	129,125,117	81,80,81	100,100,100
			+160°F	119,128,112	81,88,84	100,100,100
C4806-2	+10°F	L	-80°F	18,13	14,9	0,0
			-40°F	29,29,29	22,20,23	5,5,5
			+10°F	46,50,55	34,36,38	30,30,30
			+40°F	61,48,72	45,37,53	40,35,45
			+110°F	93,100	70,72	90,99
			+160°F	103,110	78,81	100,100

LABORATORY
[illegible]ST TEST DATA

[illegible]

Specimen Identification	Bath Medium	Test Temperature	Energy Absorbed	Lateral Expansion	% SHEAR Remarks
5UF	[illegible]	[illegible]	[illegible]1.0	62.0	75%
5U2	"	70.0	71.0	53.0	40%
5U3	"	39.0	77.0	54.0	50%
5U6	"	[illegible]	71.0	51.5	30%
5UE	"	10.0	61.0	45.0	39%
5U1	"	-10.0	60.0	49.5	30%
5U9	"	-30.0	41.0	30.0	20%
5U5	"	-30.0	40.0	27.5	20%
5U7	"	[illegible]	41.0	27.0	20%
5UL	"	-50.0	25.0	16.5	10%
5UK	"	-50.0	[illegible].5	[illegible].0	20%
5UC	H_2O	+121°	113.0	77.0	95%
5UB	H_2O	200°	116.5	82.5	95%
5UA	H_2O	200	113.5	74.0	95%
5UD	[illegible]	-90	19.0	15.5	1%

Test Procedure No. [illegible] 2.1.7.2 Rev 0
S/N Tester 110073
Calibration File No. 003-1
S/N Lateral Expansion Gage 10002
Performed by [signature]

Specimen Size 10mm x 10mm
Specimen Orientation TRANS

Level 3

'Combustion Engr., Inc.
Mr. Jack Michael, Pur.Dept.

TEST CERTIFICATE

Mill Order No.	Customer P.O.	
27439-3	40-37270	on 101868 on 101568

Remarks:

C.E.Spec. P3P12(D) 9/6/66 SA-533-65 Gr.B Class 1 Code Case 1339-2 Fdn. C9990
Cont. 3067-NP

O.K. O.K.

CHEMICAL ANALYSIS

Heat No.	C	Mn	P	S	Cu	Si	Ni	Cr	Mo	V	Ti	Al	B			
C[illegible]02	22	1.28	010	016		24	55		55					P.C	P.CV	K.P.Steel
Slab 1	23	1.30	012	016		27	56		56					n.n	n. n	n.n. n
96	22	1.33	01[illegible]	016		25	55		55					. .	. .	. . .
Slab 2	23	1.29	014	016		23	50		54							

PHYSICAL PROPERTIES

Heat No.	Slab No.	Yield Point PSI	Tensile PSI	% Elong. in 2"	% R.A.	BHN	Impact		Description
C[illegible]02	1	655	8[illegible] / 850	24			G-4404-1		1-262-1/4 x 153 x 6-1/2"
106	2	657	[illegible]	27			G-4405-3		1-257-1/4 x 152-1/4 x 7-9/16"

Tests heated 1550-1650°F., hold 4 hrs. max. and program cooled per C.E. Cooling rate for 6-1/2 & 7-9/16" th.plate. Then Tempered 1200-1250°F., hold 4 hrs.min. and air cooled. Then stress relieved 1125-1175°F., hold 40 hrs. and furnace Cooled at a rate of 4 hrs. min. to 600°F.

Plates furnished in as rolled temper.

3067

Table 3 – Sharpham Typical Beltline Plate (Surveillance Plate).

[signature]

MATERIAL SPECIFICATION .1.22(B) CONTRACT NO. 3067

VENDOR Lukens Steel Company JOB NO. V-70194-003

HEAT NO. C 4002-1 CODE NO. C-4404-1

MATERIAL DESCRIPTION 262-1/4" x 153" x 6-1/2" Lower Intermediate Shell

MILL CHEMICAL ANALYSIS											
TYPE	C	Mn	P	S	Si	Ni	Cr	Mo	Cb	Cu	
	.23	1.30	.012	.016	.27	.56		.56			

MECHANICAL TESTS						
TEST NO.	GAUGE	TEST TEMPERATURE °F	YIELD STRENGTH, KSI	ULTIMATE TENSILE STRENGTH, KSI	ELONG. IN 2" %	REDUCTION OF AREA %
WRT-A	.505	RT	70.6	91.8	25.0	68.0
WRT-B	.505	RT	70.5	92.7	25.5	66.3

IMPACT AND/OR FRACTURE TESTS							
TYPE	TEMP. °F	VALUES			TEMP. °F	VALUES	NDT
Charpy		Ft/Lbs	%Shear	Mils Lat. Exp.		Drop Weights	
V	-80	16.0	0	15	0	1 NF	-60°F
Notch	-80	14.0	0	11	-20	1 NF	
	-40	41.0	20	28	-40	1 NF	
	-40	32.0	20	22	-50	2 NF	
	-40	54.0	25	38	-60	1 F	
	+10	75.0	30	52			
	+10	68.0	30	49			
	+10	48.0	25	35			
	+40	83.0	45	59			
	+40	95.0	50	65			
	+40	100.0	60	70			
	+110	104.0	85	75			
	+110	116.0	90	82			
	+160	130.0	100	86			
	+160	131.0	100	84			

ADDITIONAL DATA INCLUDING HEAT TREATMENT:

(a) 1550 - 1650°F 4 hrs. Water quenched.
(b) 1225°F ± 25° 4 hrs. Air cooled.
(c) 1150°F ± 25° 40 hrs. Furnace cooled to 600°F.

The impacts were taken parallel to the major rolling direction of the plate at the 1/4T level and notched perpendicular to the plate surface.

The tensiles were taken in accordance with ASTM A-20-68.

These tests were witnessed by G. E. Representative, P. W. Quinlan.

Form E-113

cc: P. Webb (2)
J. Brasfield
R. E. Lorentz, Jr.
S. R. Louis
T. B. Burton

We hereby certify that the foregoing data is a true copy of the data furnished us by the producing mill, or data resulting from tests performed in the Combustion Metallurgical Laboratory.

COMBUSTION ENGINEERING, INC.

BY Wm. C. Riggs

Table 9 - [illegible] Weld Toughness Values,
Post weld 1150°F for 40 hr. Typical,
Submerged Arc Welding - B-4 Modified Wire with Linde 1092 Flux
Shielded Metal Arc Welding - E8010 Electrodes

Weld Seam	Type	Heat #	Lot ⊗ or Flux #	Drop-weight NDT °F	Charpy Toughness: Charpy Temp. °F	Charpy Toughness: Charpy Energy Ft-lbs.	Charpy Toughness: Lat. Expansion Mils	Charpy Toughness: % Shear
1-307-A	B-4 Mod.	20291	3054	NA	+10	60, 65, 59	NA	NA
	E8010	NA	HADH	NA	+10	112, 110, 114	NA	NA
	E8010	NA	LOEH	NA	+10	113, 123, 140	NA	NA
	E8010	NA	LACH	NA	+10	125, 119, 119	NA	NA
1-307-B		20291	3054 LOEH LACH	see above for toughness				
1-307-C		20291	3054 HADH LACH	see above for toughness				
1-300-G	B-4 Mod.	1P2015	3069	NA	+10	48, 48, 39	NA	NA
	B-4 Mod.	21935 & 12008⊗	3069	NA	+10	80, 74, 73	NA	NA
	B-4 Mod.	21935	3069	NA	+10	62, 74, 73	NA	NA
			LACH	see above for toughness				
1-300-H		1P2015 21935 & 12008⊗ 21935	3069 3069 3069	See above for toughness				

⊗ 2 Heats of wire - used for front head & rear head of Tandem arc submerged arc weld process.
NA = Not Available.

TABLE I Continued

Weld Seam	Type	Heat #	Lot # or Flux #	Drop-weight NDT °F	Charpy Toughness: Charpy Temp. °F	Charpy Toughness: Charpy Energy Ft-lbs.	Charpy Toughness: Lat. Expansion Mils	Charpy Toughness: %
1-300-J		1P2815 21935/12008* 21935	3069 3069 3069	See preceding page for toughness				
	E8018	NA	FAGI	NA	+10	135,121,136	NA	N[illegible]
1-313	B-4 Mod.	90099	3950	NA	+10	63,87,78	NA	N[illegible]
	B-4 Mod.	10120	3950	NA	+10	124,130,122	NA	N[illegible]
	E8018	NA	FAGA	NA	+10	120,117,116	NA	N[illegible]
	E8018	NA	CCJA.	NA	+10	95,90,96	NA	N[illegible]

* 2 Heats of wire - used for front head & rear head of tandem arc submerged arc weld process.

NA = Not Available.