GULF STATES UTILITIES COMPANY
POST OFFICE BOX 2951 • BEAUMONT, TEXAS 77704
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June 3, 1985
RBG- 21199
File No. G9.5,
G9.8.6.2

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

Dear Mr. Denton:

River Bend Station-Unit 1
Docket No. 50-458

Enclosed for your review is a Gulf States Utilities Company (GSU) supplement to the letter from J. E. Booker (GSU) to H. R. Denton (Nuclear Regulatory Commission-NRC) dated March 1, 1985 (GSU Letter No. RBG-20270). The information herein is provided to close-out Safety Evaluation Report (SER) Outstanding Issue No. 7. Enclosure 1 provides a Final Safety Analysis Report (FSAR) clarification to Section 6A.10 concerning the River Bend Station (RBS) methodology used to calculate bulk suppression pool swell impact loads for structures less than six feet above the suppression pool. The RBS approach addresses pool swell phenomena and predicts pressures on those structures which are not addressed in NUREG-0978. This approach is technically justified by comparison to alternate methods previously approved by the NRC Staff in NUREG-0487 and NUREG-0661. Attachment 1 summarizes such an alternate method (referred to as the Bedrosian methodology) which also predicts pressures on structures within six feet of the suppression pool. Attachment 2 compares the results from the RBS methodology with the Bedrosian methodology and demonstrates the RBS methodology is at least as conservative as that of this previously approved method. The FSAR revisions contained in Enclosure 1 will be incorporated into a future FSAR amendment.

Sincerely,

J. E. Booker

J. E. Booker
Manager-Engineering,
Nuclear Fuels & Licensing
River Bend Nuclear Group

eg pr #02
JEB/WJR/LAE/JWL/kt
Attachment (2)
Enclosure (1)

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ATTACHMENT 1

The following steps describe the Bedrosian methodology for calculating impact loads for structures within six feet of the suppression pool. This methodology is comprised of various procedural steps which have been previously approved by the NRC Staff in NUREG-0487 and NUREG-0661. See Attachment 2 for a tabular summary of the results.

1. Determine properties of small structure under consideration:
   - Orientation (radial or circumferential)
   - Width: W in inches
   - Height of structure's bottom above suppression pool: H in feet
   - Length: L in feet

2. Determine hydrodynamic mass of impact per unit area from GE Report No. NEDE-13426P (Reference 2, Figures (6-8) and (6-9)) corresponding to structure's orientation and width:

   (M_H/A) in lb_m/ft^2

3. Determine the impact velocity of water slug, V, corresponding to height, H:

   $V = H/10 \times (2.6 - 1.6\sqrt{H/10}) \times V_{max}$, in fps, for $0 \leq H \leq 10$ ft

   $V = V_{max} = 50$ fps, for $10 \leq H \leq 18$

4. Determine design impulse:

   $$I_p = (M_H/A) \times (V) \frac{1}{32.2 \times 144}$$, in psi x sec

5. Determine impulse duration according to G. Maise (Reference 1, Equations (5) or (9)) corresponding to structure's orientation, height above pool, and length:

   τ , in seconds (see FSAR Section 6A.10.1, Subsections 1a-d and 2a-c for a detailed procedure)

6. Determine the peak dynamic pressure design value:

   $$P_{max} = \frac{2I}{\tau^p}$$, in psi

7. Apply the impact load as a triangular impulse with the peak pressure and pulse duration determined in Step 6 and Step 5, respectively (see attached Figure 1).

REFERENCES

1. G. Maise, "Suggested Acceptance Criteria for Impact Loads on Short Mark III Structures Close to the Pool," Department of Nuclear Energy, Brookhaven National Laboratory, Upton, NY 11973, February 15, 1984.

2. General Electric Co., "Mark III Confirmatory Test Program. One-Third Scale Pool Swell Impact Tests, Test Series 5805," GE Report No. NEDE-13426P, August 1975.

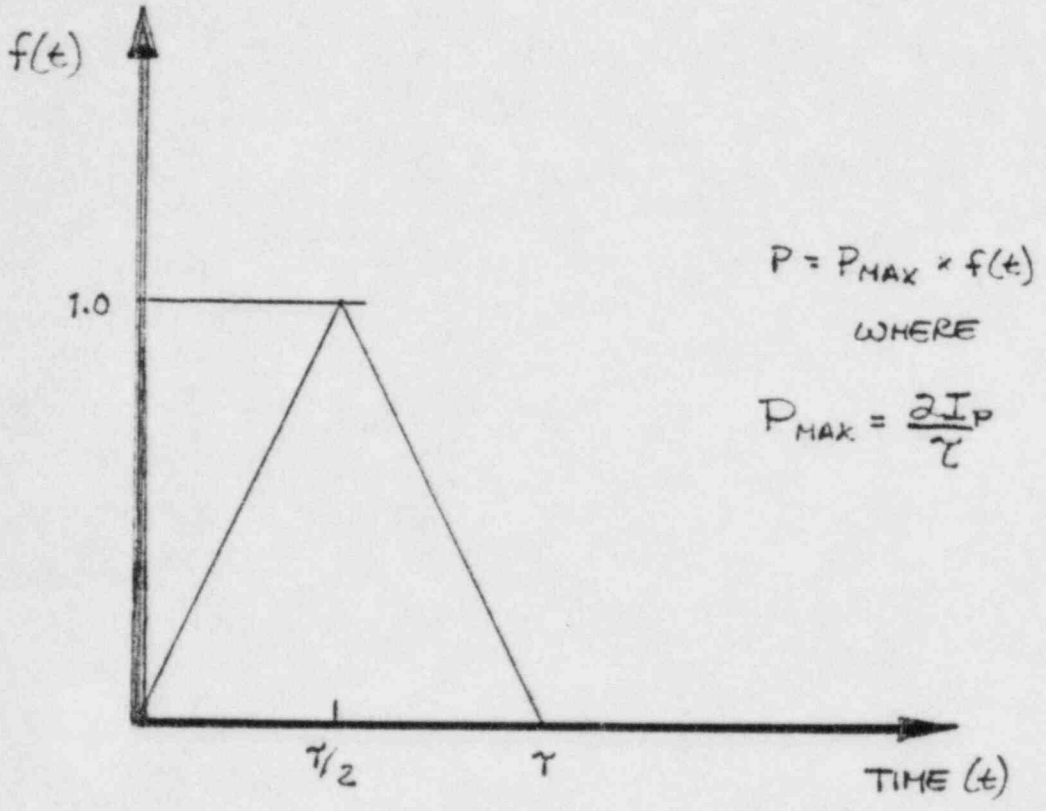

FIGURE 1

IMPACT LOAD

IMPACT ASSESSMENT OF POOL SWELL LOADING - Structures

Target	Elevation ft	Width in	Velocity ft/sec	Mh/A lbm/sqft	Structure Radial	Structure Circum	Pulse sec Radial	Pulse sec Circum	Pool Swell Impulse psi FSAR	Pool Swell Impulse psi Bedrosian	Pool Swell Impulse psi FSAR / Bedrosian
Equip Hatch Platform Framing EL 95'											
BEAM B1	94.27	6.5	33.2	15.5	X		.006		115	36.96	3.11
BEAM B2	93.6	6	29.5	15		X		.0068	115	28.05	4.10
BEAM B3	93.6	6	29.5	15	X		.0057		115	33.47	3.44
BEAM B4	91.94	8	18.4	21.5		X		.0068	115	25.06	4.10
BEAM B5	92.94	8	25.5	21.5	X		.0054		115	43.73	2.63
Cantiliver Beam at EL 95' L=4'	94.58	4	34.73	11	X		.0061		115	27	4.26
Cantiliver Beam at EL 95' L=6'	94.58	4	34.73	11	X		.0061		115	27	4.26
Control Rod Drive (CRD) Platform L) 4'	93.6	9	29.5	23.5	X		.0057		115	52.45	2.19

IMPACT ASSESSMENT OF POOL SWELL LOADING - Conduit

Equipment or Conduit	Elevation ft	Diameter in	Velocity ft/sec	Mh/A lbm/sqft	Structure Radial	Structure Circum	Pulse sec Radial	Pulse sec Circum	Pool Swell Impulse psi FSAR	Pool Swell Impulse psi Bedrosian	Pool Swell Impulse psi FSAR / Bedrosian
Conduit to RTDs - 24A,B C & H & 40D	95	1.05	36.7	.5		X		.002	121	5	24.20
Conduit to RTDs - 24E & G & 40A & C	95	1.05	36.7	.5		X		.002	121	5	24.20

RTDs are Supression Pool temperature monitoring instruments
40 A, C, and D are required post-accident

ATTACHMENT 2

IMPACT ASSESSMENT OF POOL SWELL LOADING - Pipe Stress

AX	System	Elevation ft	Diameter in	Velocity ft/sec	Mh/A lbm/sqft	Structure Radial	Structure Circum	Pulse sec Radial	Pulse sec Circum	POOL SWELL IMPULSE psi FSAR	Bedrosian	FSAR / Bedrosian
710A	DER	92.5	8.625	22.5	6.9	X		.0025		31.8	25.4	1.25
	DER	92.5	8.625	22.5	3.7		X		.0015	55.1	24	2.30
710B	DER	92.5	8.625	22.5	6.9	X		.0026		31.8	25.4	1.25
	DER	92.5	8.625	22.5	3.7		X		.0015	55.1	24	2.30
710C	DER	92.5	8.625	22.5	6.9	X		.0026		31.8	25.4	1.25
	DER	92.5	8.625	22.5	3.7		X		.0015	55.1	24	2.30
710D	DER	92.5	8.625	22.5	6.9	X		.0026		31.8	25.4	1.25
	DER	92.5	8.625	22.5	3.7		X		.0015	55.1	24	2.30
	DER	92.5	6.625	22.5	2.8		X		.0015	55.1	18.1	3.04

IMPACT ASSESSMENT OF POOL SWELL LOADING - Large Bore Pipe Supports

Pipe Support Number	Target	Elevation ft	Diameter in	Velocity ft/sec	Mh/A lbm/sqft	Structure Radial	Structure Circum	Pulse sec Radial	Pulse sec Circum	POOL SWELL IMPULSE psi FSAR	Bedrosian	FSAR / Bedrosian
1CNS-PSR-3001A4	6" SCH160	91	6.625	10.47	5.4		X		.0024	27.2	10.2	2.67
	6" SCH160	91	6.625	10.47	5.4	X		.0024		27.2	10.2	2.67

IMPACT ASSESSMENT OF POOL SWELL LOADING - Small Bore Pipe Supports

Pipe Support Number	Target	Elevation ft	Diameter in	Velocity ft/sec	Mh/A lbm/sqft	Structure Radial	Structure Circum	Pulse sec Radial	Pulse sec Circum	POOL SWELL IMPULSE psi FSAR	Bedrosian	FSAR / Bedrosian
1ICS-54* PSR3	6" SCH 40	92.5	6.625	22.5	5.4	X		.0027		30.6	19.4	1.58

LINES WITHIN 6 FEET OF THE SUPPRESSION POOL AFFECTED
BY POOL SWELL IMPACT

AX No. = 710A Line No. 1-DER-008-286-2, & Class 4 line (Penetration Z40A)

These lines are fed from Control Rod Drive Hydraulic System scram accumulator vent & drain headers - 1-DER-003-313-4 & 1-DER-003-317-4

It is assumed that all rods are inserted upon initial scram and there is no drain required post LOCA.

AX No. = 710B Line No. 1-DFR-008-403-2, & Class 4 Line (Penetration Z37A)
AX 710C Line No. 1-DFR-008-400-2, & Class 4 line (Penetration Z37B)

These lines convey drywell floor drains from the drywell through containment. They do not perform a safety function and are not required post-accident.

AX No. = 710D Line No. = 1-DER-008-450-2, & Class 4 line (Penetration Z40B)

A. These lines are fed from local instrument panel drains in containment including Class 4 lines (1-DER-750-899-4) - 3 CRD hydraulic scram accumulator vent and drain headers and 1 reactor water cleanup holding pump line.

B. These lines are fed from CRD Hydraulic System scram discharge volume piping.

It is assumed that all rods are inserted upon initial scram and there is no drain required post-LOCA.

6A.10 LOADS ON STRUCTURES BETWEEN THE POOL SURFACE AND THE HCU FLOORS

As described in Reference 1 (Section 3B.10).

6A.10.1 Impact Loads

All structures (e.g., beams and pipes) in the annulus above the suppression pool within 18 ft above the pool have widths less than 20 in. Impact loads due to bulk pool swell on these structures are as shown in Fig. 6A.10-2. For structures less than 10 ft above the pool surface, the impact pressure can be reduced by:

$$\frac{p'}{p_{max}} = \left[\frac{H}{100}\left(2.6 - 1.6\sqrt{\frac{H}{10}}\right)\right]^2 \left(\frac{V}{50}\right)^2$$

where H is the distance above the pool surface, V is the SLUG VELOCITY IN FEET PER SECOND

All beams and pipes experiencing these impact loads fall within the conservative range as defined in GESSAR Fig. 3B.33-1 through Fig. 3B.33-4, with the pulse duration τ and pressure amplitude adjusted as follows:

1. Radial-oriented structures

   a. For structures within 6 ft of the pool surface, the pulse duration τ_1 is given in Fig. 6A.10-7.

   b. For structures less than 4 ft in length, the pulse duration τ_2 is given in Fig. 6A.10-8.

   c. For structures both less than 4 ft in length and within 6 ft of the pool surface, the pulse duration is given by:

      $$\tau = (\tau_1 \times \tau_2)/0.007$$

   d. The value of τ need not be less than that calculated by:

      Cylindrical targets

      $$\tau = 0.0463\ D/V$$

Impact loads on structures attached to the containment wall are described in Section 6A.6.

Impact loads acting on structures are based on a pool swell velocity which varies with height above the pool surface. This variation is given by:

$V = 5H\,(2.6 - 0.506\sqrt{H})$ for $H < 10$ ft (SEE NOTE 1)
$V = 50$ ft/sec for $20 \geq H \geq 10$ ft

$V = \sqrt{3788 - 64.4\,H}$ for $30 \geq H > 20$ ft

6A.10.2 Drag Loads

The drag load on grating is based on Fig. 6A.10-4. The drag load found from this figure is multiplied by $(V/40)^2$ if V is greater than 40 ft/sec.

For drag loads on flat plates, Fig. 6A.10-5 is used. If the velocity is greater than 40 ft/sec, the drag load is multiplied by $(V/40)^2$. If the shorter side (b) is attached to the containment or drywell wall, the abscissa in Fig. 6A.10-5 becomes 2(a/b) instead of a/b.

For other shapes, Fig. 6A.10-6 is used to calculate the pressure for 40 ft/sec. If the pool swell velocity is greater than 40 ft/sec, the pressure is multiplied by $(V/40)^2$.

For all drag loads, the duration is 0.5 sec.

6A.10.3 Fallback Loads

As described in Reference 1 (Section 3B.10.3).

WHERE H IS THE DISTANCE ABOVE THE POOL SURFACE

NOTE 1: V LESS THAN 20 FT/SEC SHALL NOT BE USED.