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Docket Nos. 50-458/459

Mr. William J. Cahill Jr.
Senior Vice President
River Bend Nuclear Group
Gulf States Utilities Company
P. O. Box 2951
Beaumont, TX 77704
Attn: Mr. J. E. Booker

Dear Mr. Cahill:

SUBJECT: River Bend Station, Units 1 & 2: Request for Additional Information - Structural Engineering Areas.

As a result of our review of your application for operating license for the River Bend Station, we have need for additional information in the area of structural engineering. Enclosure (1) contains the questions for which a response is requested.

In response to my letter of February 5, 1982, same subject, Mr. E. Grant telephoned to advise that the questions raised in that letter would not be responded to before April 28, 1982; and that the site visit and audit requested would not be feasible until May 1982. It is urged that these questions and the additional ones in Enclosure (1) be given priority in order that our staff reviewers can complete their SER input evaluations as currently scheduled. Your help in responding to all of the questions at an earlier date is cordially requested and urged.

With regard to the site visit and audit requested, we are providing in Enclosure (2), a proposed agenda which may be helpful to you in scheduling, the meeting earlier than indicated by Mr. Grant. Such a meeting would be advantageous in expediting your responses and minimize open areas for the SER.

If there are any questions, please contact the project manager assigned to your project.

Sincerely,

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosures:
As stated
cc: See next page

OFFICE		DL:LB#2/PM	DL:LB#2/BC				
SURNAME		JStefano:pt	ASchwencer				
DATE		2/19/82	2/19/82				

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ENCLOSURE 1

QUESTIONS - RIVER BEND

220.0 STRUCTURAL ENGINEERING BRANCH

220.12 (3.3.2.2.3) The table referred to in paragraph 3.3.2.2.3 is an inccorect reference. Please provide the correct reference for tornado missiles.

220.13 (3.3) Provide an explanation of your reasons for not providing tornado protection for the radwaste building above grade as noted in footnote (27) of Table 3.2-1 of the FSAR.

220.14 (3.3.2.2.4) The tornado load combinations listed in paragraph 3.3.2.2.4 of the FSAR do not contain the following as explicit combinations:

$$W_t = W_w$$
$$W_t = W_m$$
$$W_t = W_w \text{ to } .5\ W_p$$

Provide justification for this omission or include the above combinations in your analysis.

220.15 (3.4.2) Table 3.4-1 indicates that the design basis flood level (DBFL) is at 95' - 1" above mean sea level (MSL). Table 1.3-8 indicates that the DBFL is at 98' - 6" above MSL. Which is the correct value? If the higher level is correct, what are the consequences?

220.16 (3.4.2) Table 3.4-1 indicates that the design basis flood level (DBFL) for ground water is 70' - 0" above mean sea level (MSL). It is stated in the first entry of Table 1.3-8 that the ground water will rise a maximum of 13' - 0" above the normal ground water level of 57' - 0". Assuming that the 70' - 0" MSL was used to determine lateral earth pressures, how was it assured that the ground water level would not rise above the 70' - 0" MSL under some circumstances.

220.17 (3.4.2) Provide an explanation and derivation for the expressions listed in Figure 2.5-79 and, in particular, the asterisked footnote as well as the pressure diagram at the extreme right referring to compaction loads.

220.18 (3.5.3) Provide a comparison of the tornado missile barrier thickness used for all Category 1 concrete structures at the plant and those listed in the NRC S.R.P., NUREG 0800, Section 3.5.3, Table 1, Revision 1 dated July 1981. Where wall or roof thicknesses are less than those noted in the S.R.P., provide an explanation.

220.19 (3.5.3) Are there any openings in the walls or roofs of Category 1 structures (for example, for ventilation) which could allow a tornado missile to pass? If so, what protection is provided to protect targets in way of the openings?

220.20 (3.5.3) For concrete structural components designed to resist impactive or impulsive loads, provide a comparison of the design criteria you used for allowable ductility ratios and the criteria outlined in Appendix C of ACI 349 as modified by USNRC Regulatory Guide 1.142. Provide an explanation for any unconservative differences.

220.21 (3.5.3) For steel structural components designed to resist impactive or impulsive loads, provide the design criteria for allowable ductility ratios and technical basis. Compare your criteria with that found in Appendix A of USNRC S.R.P. 3.5.3 and provide an explanation for any unconservative differences.

220.22 (3.5.3) Provide justification for adopting the methods of Appendix C of SWECO 7703 for the evaluation of overall response of barriers to missile impact. It is understood that this method is somewhat less conservative than that recommended by Williamson & Alvy.

220.23 (3.7.1.2A) Demonstrate that the frequency intervals, at which spectra values are calculated from the design time history, are small enough such that any reduction in these intervals does not result in more than 10% change in the computed spectra.

220.24 (3.7.2.1.A) Is the seismic analysis method used for Category 1 structures at River Bend (response spectrum modal analysis) conservative with respect to a finite boundary approach in which the soil column is modeled as a finite element mesh? Provide the basis for your answer.

220.25 (3.7.2.1.1.2A) You state that: "The number of mass points is then increased until additional mass points do not appreciably change the dynamic characteristics of the model." The staff criteria is that the number of mass points included in the model is adequate if the inclusion of additional masses will not increase responses by more than 10%. Indicate if such is the case and provide justification and further details if it is not.

220.26 (3.7.2.1.1.2A) Indicate if the number of modes considered in your analyses of Category 1 structures is such that the consideration of additional modes will not result in more than a 10% increase in responses. Provide further details and justification if such is not the case.

220.27 (3.7.2.1.1.3A)
Provide a summary of natural frequencies mode shapes and responses for the Standby Service Water Cooling Tower and Standby Service Water Pump House.

220.28 (3.7.2.1.1.3A)
Provide a tabulation of the "rattle space" surrounding Category 1 structures along with an adjacent tabular listing of the worst-condition gaps between the structures. If any excursions greater than the "rattle space" are indicated, provide an explanation.

220.29 (3.7.2.4A)
Discuss your approach to soil layer modeling in your analysis of the plant structures for seismic loads and the construction of soil springs.

220.30 (3.7.2.5A)
Explain why the off-diagonal terms of the damping matrix C "...are ignored with no significant loss of accuracy..."

220.31 (3.7.2.7A)
Provide an equation to describe the method used to combine closely spaced modal responses.

220.32 (3.7.28A)
Will the collapse of any non-Category 1 structure impair the integrity of any seismic Category 1 structure or component? If so, is the non-Category 1 structure designed to Category 1 standards? Provide an explanation if necessary.

220.33 (3.7.2.11A)
In your consideration of torsional effects, in the dynamic analysis of Category 1 structures, was an additional Eccentricity of 5% of the maximum building or structure dimension added to account for inaccuracies in determining torsional effects? If not, explain your reason for not adding in such a conservatism.

220.34 (3.7.2.12A)
DELETED

220.35 (3.7.2.15A) (3.7.2.5A)
Show the formulation by which the equivalent modal damping ratios are defined. Also, provide an explanation of your statement, quoted as follows, and the method referred to therein:

> "The modal damping is determined by the ratio of dissipated energy to strain energy for each mode shape, a method which provides realistic estimates of damping, especially in models which contain large foundation translations or rotations(5)."

220.36 (3.7.2.15A)
Explain the reference, in the last paragraph of this section, to "the stress intensities given in Regulatory Guide 1.61."

220.37 (3.7.2.15A) Provide an explanation and justification for choosing a 10% damping ratio for subgrade components as opposed to some other values. Define the phrase "subgrade components."

220.38 (3.7.2.16A) Provide a detailed, step by step explanation of the method for applying the earthquake input to the radwaste building; i.e., clarify and expand the last paragraph in this section.

220.39 (3.7.3.1.1.1A) For the static analysis method, provide justification for applying a static coefficient to the peak acceleration of 1.3 rather than the usually accepted value of 1.5. Also, provide justification for not applying the static coefficient in all situations.

220.40 (3.7.3.1.1.1A) Show that the static analysis will always provide conservative results when compared to a dynamic analysis.

220.41 (3.7.3.1.1.2A) For the dynamic analysis of seismic Category 1 subsystems provide an additional explanation of the method and indicate if the following items have been considered.

(a) DELETED

(b) Use of an adequate number of masses or degrees of freedom in dynamic modeling to determine the response of all applicable components and plant equipment. The number is considered adequate when additional degrees of freedom do not result in more than a 10% increase in responses. Alternately, the number of degrees of freedom may be taken equal to twice the number of modes with frequencies less than 33 cps.

(c) Investigation of a sufficient number of modes to assure participation of all significant modes. The criterion for sufficiency is that the inclusion of additional modes does not result in more than a 10% increase in responses.

(d) Consideration of maximum relative displacements among supports of structures, systems, and components.

(e) Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.

220.42 (3.7.3.12A) Describe in detail the methods of seismic design and analysis, pertinent design criteria and results of your design for buried structures, other than piping, which house safety related components or systems. Provide a

diagram of the site showing all such seismic Category 1 buried structures.

220.43 (3.7B) Provide a list of all structures and/or components of structures which are designed in accordance with the requirements of Section 3.7B of the FSAR. For those structures and/or components of structures designed in accordance with Section 3.7B, describe the location of the interface with other structures and explain why the interface was chosen in that place (unless it is otherwise readily apparent). For any structures designed in accordance with 3.7B, discuss the differences in methods of design between 3.7A and 3.7B, particularly with respect to the degree of conservatism of the design.

220.44 (3.7.4) Describe the seismic instrumentation surveillance scheme for the plant. The staff's requirement for such a program is as follows:

Seismic monitoring instrumentation surveillance requirements

Instrument	Channel check	Channel calibration	Channel Functional test
1. Triaxial time-history accelerographs	M	R	SA
2. Triaxial peak accelerographs	NA	R	NA
3. Triaxial seismic switches	M	R	SA
4. Traixial response-spectrum recorders	M	R	SA

Legend:

M = Monthly
R = Refueling
SA = Once per 18 months
NA = Not Applicable

Each of the seismic instruments shall be demonstrated operable by the performance of the channel check, channel calibration, and channel functional test operations at the intevals specified above.

Explain and justify any deviations from the above.

220.45 (3.8.2) In Table 3.8-1 define the Design and Operating categories listed in the first column in terms of ASME Code service limits as well as plant conditions.

220.46 (3.8.2) Provide construction drawings showing the dome/cylinder interface of the containment and the mat/cylinder interface of the containment.

220.47 (3.8.2) Provide a construction drawing of the polar crane support and its attachment to the containment.

220.48 (3.8) Provide details of the materials used for O-rings, seals, waterstops and filler materials used for doors and structural applications in and between all Seismic Category 1 structures. Has proper consideration been given to choosing materials such that these items will not be subject to deterioration from radiation as well as all other environmental factors? Provide discussion.

220.49 (3.8.3) The staff's proposed criteria concerning shell buckling is as follows:

Structural Engineering Branch
Safety Factor For Shell Containment Shell Buckling

Under normal operating condition, the steel containment should maintain a minimum of 3.0 safety factor for all loading combinations. The safety factor (S.F.) is defined as follows:

$$\text{S.F.} = \frac{\text{Buckling strength of the containment shell}}{\text{Buckling load imposed on the shell}}$$

When design bases accident loads are considered, the safety factor should be minimum of 2.0.

The staff position supersedes the safety factor provided in the following:

1) NE 3133 (NB 3133)*
2) NE 3222*
3) NRC SRP 3.8.2

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*ASME Section III, Summer 1977 Addenda

Discuss the design of the River Bend containment with respect to compliance with the above.

220.50 (3.8.2) Provide additional details showing how the containment linear is fastened to the base slab (i.e., welded studs, if used) in the field of the liner plate.

220.51
(3.8.2.3.1)

It is noted in Section 3.8.2.3.1 of the FSAR that some stress limits will be higher than those indicated in Regulatory Guide 1.57. Provide numerical comparisons of how much the guidance of the Regulatory Guide is exceeded and state how you arrived at your acceptance criteria values.

220.52
(3.8.2.4.1)

For combining various dynamic loads, which may be applied simultaneously to the containment, it is the staff's position that the absolute sum method should be used unless their actual time histories of occurrences are employed. If the latter method is to be adopted, details of the method should be provided. It is to be noted that the method described in Section 3 BA.8.4 of GESSAR 238 has not been accepted by the staff. Discuss the compliance of the River Bend Containment design to the above.

220.53
(3.8.2.4.1)

There is in the staff's position on MK III Containment generic issues a fatigue analysis requirement for the liner of concrete containment. For steel containment the consideration of fatigue is specified in ASME Code Section III Division 1. However, the liner on the concrete foundation mat of a steel containment should be treated as the liner of a concrete containment. Since the staff position requires the pool liner to be designed in accordance with the ASME boiler and pressure vessel code Division 1, subsection NE, it is suggested that conditions and procedures to consider fatigue of both the steel containment and the steel liner in the concrete containment be established generically. State the procedures and results by which fatigue was considered in the design of the containment and mat liner.

220.54
(3.8.4)

Do you have any masonry walls at River Bend Station, the failure of which could damage a safety related component or system? If so, respond to this question as requested in I&E Bulletin 80-11 of May 8, 1980, except that the schedule for submittal is not applicable. (The staff's acceptance criteria for masonry construction is outlined in Appendix A to SRP Section 3.8.4, NUREG-08000, Revision 0, dated July 1981.)

220.55
(3.8.4)

The staff is aware that the applicant intends to use a particular type of drilled anchor bolt (Drillco - Maxi Bolt) for anchoring all types of equipment to concrete structures throughout the plant. We are also aware that the applicant intends to use a lower factor-of-safety for these anchors than has been outlined in I&E Bulletin 79-02. It is understood that the rationale for doing so is that the Drillco Maxi Bolts are 100% proof tested in place and also are backed by extensive laboratory tests and some field experience. The staff's concern is that the proof tests do not test the in-place failure cone of the anchor bolts and that the concrete, because it is subject to

variability of quality at any given place, is the weak link. Laboratory tests cannot guarantee the behavior of in-situ concrete in a given location. Accordingly, the applicant is requested to address the above concerns and provide complete assurance that the anchor bolts will perform as intended or increase the factor-of-safety for the anchor bolts.

220.56 (3.8.2) (3.8.3) (3.8.4) (3.8.5) — Provide a Design Report, as outlined in Appendix C to SRP Section 3.8.4 (NUREG-0800, Rev. 0, July 1981) for all seismic Category 1 structures.

220.57 (3.8.4) — Provide construction drawings of the spent fuel racks, and the spent fuel pool and its liner.

220.58 (3.8.3) (3.8.4) — The current staff position is that seismic Category 1 concrete structures, other than the containment, should be designed in accordance with ACI 349 and modified by NRC Regulatory Guide 1.142, rather than ACI 318. Indicate the instances where the design of the River Bend seismic Category 1 concrete structures would be unconservative with respect to the staff's current criteria and provide an explanation.

220.59 (9.1.2) — Indicate whether material, fabrication, welding, and quality control of the spent fuel racks ,in both containment and fuel building, are in conformance with subsection NF of the ASME Code. If not, identify and justify the deviations.

220.60 (9.1.7) — Provide the load combinations and acceptance criteria used in the design of the fuel pool liner. Indicate how the leak tight integrity of the fuel pool liner will be maintained in the event of a heavy drop accident. Indicate how the structural integrity of the fuel pool slab will be maintained in the event of a heavy drop accident.

220.61 (9.1.2) — Provide the sketches of the mathematical models used in the design of the spent fuel racks, in both containment and fuel building. Describe in detail, the methods of analysis including, treatment of non-linear conditions due to gaps or friction, friction forces, boundary conditions, spring-mass locations, fluid modeling and damping considerations. Describe the methods by which seismic and other loads are applied to the racks and the pool.

220.62 (9.1.2) — Indicate the specifications for the materials used in construction of the spent fuel racks as well as the liner for the spent fuel pool.

220.63 (9.1.1) — Answer questions 220.60, 220.61, and 220.62 for the new fuel racks.

220.64 (9.1) — Provide key structural drawings of the new fuel racks and of both types of spent fuel racks.

ENCLOSURE 2

PROPOSED AGENDA FOR USNRC,
STRUCTURAL ENGINEERING BRANCH (SEB)
SITE VISIT OF RIVER BEND STATION
AND STRUCTURAL DESIGN AUDIT

Dates of Site Vist:
Location of Site:
Dates of Audit:
Location of Audit:

Date and time — Agenda item/conducted by

1. Site Visit (all parties meet at construction office) by 2 or 3 SEB Personnel/GSU.

2. Audit Introduction/SEB

   a. Purpose

   b. Expected end product

   c. Procedures

3. Overview of Plant Design/GSU

   a. Status, Key Milestones

   b. Construction status

4. Audit Subjects/ GSU & SEB

   a. Steel Containment

      (1) Audit Guidelines

      (2) Seismic Design

      (3) Buckling Capacity

      (4) Ultimate Capacity

      (5) Internal Structures

      (6) Openings and Hatches

      (7) Action Items

      (8) SEB Questions and Review

Date and time	Agenda item/conducted by (continued)
	b. Shield Building
	(1) Audit Guidelines
	(2) Seismic Design
	(3) Wind & Tornado Design
	(4) Interior Structures
	(5) Openings and Hatches
	(6) Action Items
	(7) SEB Questions and Review
	c. Auxiliary Building
	(1) Audit Guidelines
	(2) Seismic Design
	(3) Wind & Tornado Design
	(4) Masonry Walls
	(5) Supports (cable, pipe, equipment, ventilation)
	(6) Action Items
	(7) SEB Questions and Review
	d. Fuel Building
	(1) Audit Guidelines
	(2) Seismic Design (Racks and Pool)
	(3) Wind & Tornado Design
	(4) Masonry Walls
	(5) Action Items
	(6) SEB Questions and Review

Date and time

Agenda item/conducted by (continued)

e. Other Category 1 Structures

(1) Audit Guidelines

(2) Seismic Design

(3) Wind & Tornado Design

(4) Masonry Walls

(5) Supports (equipment, etc.)

(6) Action Items

(7) SEB Questions and Review

f. Buried Structures and Foundations (Category I)

(1) Audit Guidelines

(2) Seismic Design

(3) Soil Structure Interaction

(4) Hydrostatic Loadings

(5) Action Items

(6) SEB Questions and Review

5. Summary/SEB & GSU

a. Action Items - list

b. SEB Questions - list

c. Schedule for response to action items and questions.