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August 9, 1984
RBG- 18,565
File Code G9.5, G9.19.2

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

This response supplements Gulf States Utilities Company's (GSU) June 22, 1984 letter to your office regarding the Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) confirmatory item No. (3) identified in Section 2.5.5.2 by the Structural and Geotechnical Engineering Branch (SGEB). Addressed herein is the factor of safety against sliding for the service water tunnel (G) that leads to the Unit 2 excavation area. Attached are changes to Section 2.5.4.11 and Table 2.5-16 to be provided in a future amendment to the FSAR.

This completes GSU's response to SER confirmatory item No. (3).

Sincerely,

J. E. Booker

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

JEB/RJK/je

Attachment

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## 2.5.4.11 Design Criteria

The major plant buildings were analyzed to assess their
sliding and overturning stability during the SSE and OBE.
The analyses included the effects of the Unit 2 excavation
and ponded water levels that result from the accumulation of
runoff in the Unit 2 excavation as discussed in Section 2.4.
Although the groundwater level will be slightly affected by
ponding, the stability analyses conservatively consider the
13 groundwater level equal to the ponded water level to
simplify the analyses.

For the sliding and overturning analyses, a structure is
and soil assumed to be driven by the seismic response of the
pressure structure and dynamic soil and water pressures. Resistance
13 is assumed to be provided by base friction, ~~and~~ wall
friction, where appropriate, in the case of sliding and by — and soil pressure, where appropriate
the dead weight of the structure in the case of overturning.
Since many of the structures will have a shake space
adjacent to them (for seismic isolation from other
13 structures), passive soil pressure is not relied upon for
resistance in this stability analysis. The compacted sand
backfill was modeled with a friction angle of 36 deg and no
cohesion. Test results on the backfill indicate this
friction angle to be conservative (refer to Fig. 2.5-74 and
to Report on Engineering Characteristics of Granular
13 Fill[77]). The friction angle for backfill against formed
concrete is taken as 50 percent of the soil friction angle.
The base friction angle for concrete poured on compacted
fill was taken as ~~90 percent of~~ the soil friction angle,
reduced in accordance with ~~This is based on~~ the laboratory test results of
Potyondy[84]. For the sliding analysis, the base shear
resistance is based on the effective stress during the
seismic event.

The seismic responses of the structures are the results of the dynamic analyses described in Section 3.7.2. The seismic structural analyses were made for the SSE and OBE cases for soil shear moduli of 12, 18, and 24 ksi. The dynamic analyses provide the axial forces, shear forces, moments, and the three components of acceleration at the foundation level. From these data, the forces and moments acting at the base of the foundations were computed. The critical sliding or overturning situation for a given structure is then based on the least favorable direction of the earthquake in combination with the least favorable soil shear modulus.

For the stability analysis, the soil- and water-driving
pressures were computed as shown on Fig. 2.5-79. Note that — Insert A
the increased $K_0$ due to compaction was included. Dynamic



for the at-rest condition

Insert A

except for the analysis of the service water tunnel. Toward the east end of this tunnel, the backfill is placed to the same elevation on the north and south sides of the tunnel. Therefore, it is assumed that at-rest earth pressures act near the east end of the tunnel. Toward the west end of the tunnel, the backfill on the north side is 28 ft. higher than the backfill on the south side. It is assumed that near the west end of the tunnel sufficient movement of the tunnel occurs to reduce driving earth pressure from at-rest to a condition that approaches active earth pressure ($K_o = 0.35$). For intermediate sections of the tunnel, driving earth pressure is varied from slightly above active at the west end to at-rest at the east end.

structural response and the seismic soil and water pressures.

Section 3.8.5 specifies that, for sliding and overturning, the minimum required factors of safety are 1.1 for SSE and 1.5 for OBE. The results of the sliding and overturning analysis are presented in Table 2.5-16, which is a listing of the calculated factors of safety. Note that even with the conservative loading conditions and soil properties used in the analysis, all factors of safety for overturning are
8 above 1.9 and all those for sliding are above 1.5 7. All 2 13
major structures have adequate sliding and overturning stability for OBE and SSE loading.

The stability of the major structures against flotation was evaluated by comparing maximum buoyant pressure during PMF with total average distributed dead load for a given structure. Table 2.5-17 lists both of these quantities and the ratio of the two. The lowest factor of safety against flotation is 2.6, well above the minimum acceptable of 1.1 13
which is set forth in Section 3.8.5. Hence, flotation is not a realistic possibility for the plant structures, even under flood conditions.

2.5.4.12 Techniques to Improve Subsurface Conditions

The only techniques used to improve subsurface conditions were the excavation and backfill beneath all Seismic Category I structures (Section 2.5.4.5). In addition, the surface of the excavation was thoroughly compacted with the same vibratory equipment planned for the fill before any backfill was placed.

2.5.4.13 Subsurface Instrumentation

The instrumentation program is intended to measure the magnitude and distribution of vertical soil movements caused by unloading of the foundation soils during excavation and by settlement or reconsolidation of these soils during and subsequent to placement of the structural backfill and foundation loads. The locations of instruments have been chosen to measure both the vertical and horizontal distribution of soil movements, permitting construction of profiles of vertical movements.

The information obtained from this program is used to assess the changes in the subsoils caused by excavation and backfilling, the effects of these changes on the structural foundations, and the long term time-dependent behavior of the foundations.

TABLE 2.5-16

SLIDING AND OVERTURNING FACTORS OF SAFETY
FOR MAJOR STRUCTURES

| Structure | Factor of Safety | | | |
|---|---|---|---|---|
| | OBE | | SSE | |
| | Sliding | Overturning | Sliding | Overturning |
| Diesel Generator Building | 2.6 | 6.5 | 1.6 | 3.6 |
| Control Building | 2.3 | 6.0 | 1.6 | 3.7 |
| Fuel Building | 2.9 | 3.8 | 1.7 | 2.0 |
| Turbine Building | 4.2 | 23.7 | - | - |
| Reactor Building | 5.1 | 6.5 | 2.9 | 3.8 |
| Auxiliary Building | 3.3 | 4.5 | 1.6 | 2.4 |
| Standby Service Water Tower | 2.7 | 7.4 | 1.8 | 4.7 |
| Service Water Tunnel | 2.3 (3.3) | 2.6 (4) | 1.5 (1.7) | 1.9 (8) |

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