MISSISSIPPI POWER & LIGHT COMPANY
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P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

October 14, 1983

NUCLEAR PRODUCTION DEPARTMENT

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
License No. NPF-13
File: 0727/L-334.0/L-860.0
SER Confirmatory Item 1.10(4), Soil Structure Interaction
AECM-83/0654

In fulfillment of our commitments made on the subject of soil-structure interaction and in response to your letter of January 12, 1983, Mississippi Power & Light (MP&L) has utilized the elastic half space methodology and Grand Gulf time history to generate floor response spectra for the deeply embedded Standby Service Water Cooling Tower Basin (SSWCTB). As stated in Section 3.7.1 of Supplement 1 to the Grand Gulf Nuclear Station Safety evaluation Report, December 1981, the use of Grand Gulf time history is conservative at frequencies greater than 1 Hz. Since the fundamental natural frequency of the SSWCTB is significantly greater than 2 Hz, the application of the Grand Gulf time history to the elastic half space analysis of the SSWCTB is consistent with the conclusions of the SER and is considered appropriate.

An engineering assessment of the impact to the basis for design qualification of all mechanical and electrical equipment, components, and piping in the SSWCTB has been performed considering the NRC Structural Engineering Branch position for seismic analysis. Specifically, all equipment, components, and piping in the SSWCTB have been evaluated against the envelope of the floor response spectra generated using both the elastic half space methodology (unmodified for embedment) and the finite element methodology. This approach has shown the need to modify nine (9) existing pipe supports and add four (4) pipe supports; no other hardware modifications are required. Consistent with Operating License Condition 2.C.(6), MP&L will complete all required modifications prior to startup following the first refueling outage.

Additionally, as requested by the NRC Structural Engineering Branch during a meeting with MP&L held in Bethesda, Maryland on March 16, 1983, a summary of the analytical methods used to address the soil-structure interaction issue for Category I structures and equipment, components, and piping housed in these structures is provided in the attachment to this letter.

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Please advise if further information is required.

Yours truly,

L. F. Dale
Manager of Nuclear Services

GS/JGC:rg

Attachment

cc: Mr. J. B. Richard (w/a)
Mr. R. B. McGehee (w/a)
Mr. T. B. Conner (w/a)
Mr. G. B. Taylor (w/a)

Mr. Richard C. DeYoung, Director (w/a)
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. J. P. O'Reilly, Regional Administrator (w/a)
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Summary of Soil-Structure Interaction
for Grand Gulf Nuclear Station

The acceleration response spectra for nonembedded Category I structures, i.e., the containment, control, auxiliary, and diesel generator buildings, were originally generated using an elastic half space methodology and the Grand Gulf time history. As a result of the August 27, 1981 meeting between MP&L and the NRC Structural Engineering Branch (SEB) and prior to the issuance of the Grand Gulf Safety Evaluation Report in September 1981, MP&L agreed to compare this analysis with a finite element analysis using Regulatory Guide 1.61 damping values and applying the free field input motion in accordance with Regulatory Guide 1.60. However, as subsequently stated in Section 3.7.1 of Supplement 1 to the Grand Gulf Nuclear Station Safety Evaluation Report, December 1981, the use of Grand Gulf time history is conservative at frequencies greater than 1 Hz. Since the fundamental natural frequencies of all the nonembedded Category I structures are greater than 2 Hz, the application of the Grand Gulf time history to the elastic half space analysis of these structures is consistent with the conclusions of the SER and is considered appropriate. The results of the comparison of the elastic half space and finite element methodologies were provided to the NRC via AECM-82/122, dated April 2, 1982. This comparison did not affect the seismic qualification of safety-related mechanical and electrical equipment, components, and piping located in nonembedded Category I structures. Based on the preceding discussion, MP&L considers the soil-structure interaction issue resolved for nonembedded Category I structures.

As stated in FSAR subsection 3.7.2.1.1.3.5, a finite element method of seismic analysis was used to generate design floor response spectra for the deeply embedded Standby Service Water Cooling Tower Basin (SSWCTB), and an elastic half space method of seismic analysis was used to generate SSWCTB structural design loadings. Both methods used free field motion defined by the Grand Gulf design spectrum. In a letter from R. L. Tedesco (NRC) to J. P. McGaughy (MP&L), dated August 29, 1980, the NRC, via FSAR Question 130.25, required that MP&L assess the impact of the NRC Structural Engineering Branch position on seismic analysis of the SSWCTB. Specifically, MP&L was required to compare the original elastic half space analysis used in the structural design of the SSWCTB with a finite element analysis and compare the floor response spectra generated using the original finite element analysis with an elastic half space analysis. A summary of the impact of the NRC position on the structural design of the SSWCTB was provided in the response to Question 130.25 in Amendment 47 to the Grand Gulf FSAR.

A more detailed discussion of the impact of the NRC position on the design of equipment, components, and piping in the SSWCTB was provided in AECM-82/122. Since the elastic half space methodology fails to completely account for the embedment effect associated with the soil-structure interaction phenomenon, MP&L concluded in AECM-82/122 that implementation of the NRC position on seismic analysis could impact the design qualification of the SSWCTB equipment, components, and piping. This conclusion was supported by both a parametric finite element sensitivity study and test data of embedment effects, which showed a forth (40) to seventy (70) percent reduction in response spectra amplitudes from the nonembedded model to the embedded model. Reduction of elastic half space response spectra by forty (40) percent resulted in good agreement between the amplitudes of the finite element

analysis and the elastic half space analysis. Therefore, it was MP&L's position that the existing basis for qualification of systems and components in the SSWCTB was adequate and should be maintained.

In a January 12, 1983, letter from A. Schwencer (NRC) to J. P. McGaughy (MP&L), the NRC Structural Engineering Branch rejected the application of a forty (40) percent reduction factor to the response curves generated by the elastic half space methodology as applied to the deeply embedded SSWCTB, reasoning that, "...Since the concept and assumptions of both soil modeling methods are different [finite element versus elastic half space], the experience of one should not be applied indiscriminately to the other..."

Subsequently, MP&L met with the NRC Structural Engineering Branch on March 16, 1983 in Bethesda, Maryland to discuss the proposed approach for responding to the NRC letter of January 12, 1983. As a result of this ongoing dialogue with the NRC, MP&L has committed to utilize the elastic half space methodology (without the proposed forty (40) percent reduction factor) and Grand Gulf time history to generate floor response spectra for the deeply embedded SSWCTB. The results of the envelopment of the elastic half space analysis (reference AECM-82/122) and the finite element analysis are described in the body of this letter. Consistent with Operating Licensing Condition 2.C.(6), MP&L will complete all required modifications prior to startup following the first refueling outage.