UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 14 1984

Docket Nos. 50-424/425

MEMORANDUM FOR: [redacted] Chief
Licensing Branch No. 4
Division of Licensing

FROM: George Lear, Chief
Structural and Geotechnical Engineering Branch
Division of Engineering

SUBJECT: REVIEW QUESTIONS - GEOTECHNICAL ENGINEERING

Plant Name: Vogtle Electric Generating Plant, Units 1 and 2
Licensing Stage: OL
Docket Number: 50-424/425
Responsible Branch: Licensing Branch No. 4, M. Miller, LPM

We have reviewed Section 2.5.4 of the Vogtle Electric Generating Plant (VEGP), Units 1 and 2 FSAR submitted by Georgia Power Company in support of their application for an Operating License for VEGP. On the basis of this review we have identified the additional information needed to complete our safety evaluation. The enclosed questions prepared by Joseph Kane and Dinesh C. Gupta, Geotechnical Engineering Section, Structural and Geotechnical Engineering Branch, Division of Engineering, have been prepared for your transmittal to the applicant.

Enclosure 2 identifies reports referenced in the FSAR which need to be provided by the Applicant in order to complete our safety review.

George Lear, Chief
Structural and Geotechnical
Engineering Branch
Division of Engineering

Enclosure:
As stated

cc: J. Knight
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Enclosure 1

Vogtle Electric Generating Plant, Units 1 and 2
Docket Nos. 50-424/425
FSAR Review Questions
Geotechnical Engineering Section
Prepared by J. Kane, DE, SGEB, GES with
Input from D. Gupta, DE, SGEB, GES

241.1 (SRP 2.5.4) Table 1.3.2-1 should identify the foundation design change from the PSAR to place one of the seismic Category 1 structures (the Radwaste Solidification Building) on drilled caissons.

241.2 (SRP 2.5.4) The FSAR does not provide a plan that clearly identifies all seismic Category 1 structures, piping and conduits in relation to their foundation conditions. We recommend a plan similar to Figure 2.5.1-23, Sheets 2 and 3 be developed that provides the following minimum information:

1. Outline of all seismic Category 1 structures including tanks and tunnels and the location (alignment) of seismic Category 1 piping and conduits.

2. Location of foundation excavations (Top and bottom elevations, slopes) including the outline of the deeper excavation to Elev. 108.6 ft.

3. Sufficient bottom foundation elevations of piping and conduits to understand the depth of fill beneath them and elevations of piping penetrations into structures.

4. The extent of riprap placement and the excavation slopes that slumped which are described on Page 2.5.1-24. If clarity of drawing permits, the extent of the eroded Category 1 backfill areas that occurred in November 1979 should also be shown (refer to Q 241.23).

5. The location of borings and test pits used to define geologic and foundation conditions.

241.3 (SRP 2.5.4) The borings drilled in the clay marl bearing stratum after completion of the power block excavation (See page 2.5.4-4) indicate poor core recovery in nine of the 36 borings completed. No explanation or discussion on this poor core recovery is offered in the FSAR. To assist the Staff in its assessment of foundation adequacy we request that representative cores be made available for inspection at the planned site visit. The selection of recovered cores for display should include boreholes where recovery was poor as well as good and cover the entire depth of the marl layer and should be

241.3 (Continued) for boring locations in the vicinity of important seismic Category 1 structures. To better understand the procedures followed in the selection of important soil and foundation design parameters (shear strength, soil modulus, etc.) for this highly variable clay marl stratum, we request that engineers knowledgeable in this selection procedure that was completed be available for discussions during the site visit.

241.4 (SRP 2.5.4) Provide a summary of the actual results for control testing completed on compacted Category I backfill. The summary should permit the location and elevation of backfill material tested to be recognized and graphically demonstrate how PSAR commitments on Category 1 backfill requirements were fulfilled (gradation, placement moisture content, in situ density, moisture-density relations and percent compaction).

241.5 (SRP 2.5.4) Provide a table with the as-built dimensions (length and width) for all seismic Category 1 structural foundations and indicate the bottom elevations of foundation slabs. To understand the magnitude of actually applied bearing stresses provide the applied gross and net loading stresses (dead, live and seismic loading) for all seismic Category 1 structures including valve house, pumphouses and tanks. Table 2.5.4-12 needs to be revised to include the results of bearing capacity analysis for all seismic Category 1 structures. The maximum permissable foundation pressures listed in the last column of Table 2.5.4-12 appear to be in error and appropriate corrections should be made. The factors of safety under dynamic loading conditions should also be provided.

241.6 (SRP 2.5.4) Please identify the location of observation wells 101 A, 247, 248, 806B and 807A on Figure 2.4.12-6. Verify that the water level measurements presented for these wells on Table 2.4.12-7 are in agreement with the water table contours and piezometric surfaces shown on Figures 2.4.12-6 and 2.4.12-7. Table 2.4.12-7 should also identify the bottom elevations of the observation wells.

241.7 (SRP 2.5.4) Describe water level measurements made at observation wells T-1, MU-1, MU-2, 138 and 181 and show that these measurements are consistent with the shown contours on Figures 2.4.12-6 and 2.4.12-7. The contours drawn in the area of wells 27 and 157 are not consistent with the water level measurements presented in Table 2.4.12-7. Explain this inconsistency or revise contours.

241.8 (SRP 2.5.4) Provide water level measurements available in the plant area (Detail A - Figure 2.4.12-6) after 1974 in the aquiclude and confined aquifer.

241.9 (SRP 2.5.4) The staff has difficulty in understanding the statement "The marl contains no free ground water and no springs, etc." (Page 2.5.4-21, third paragraph) in view of the water level measurements submitted in Table 2.4.12-7 for the marl aquiclude. A groundwater pressure diagram should be provided for depths that extend into the lower confined aquifer. The diagram should reflect the hydrostatic pressures used in the design of structures founded on or in the clay marl stratum. Address the possibility that the water head loss across the marl layer results from openings or cavities in the lower portions of the clay marl layer. We request a figure be provided that presents a sectional view of the typical installation details for the observation wells installed in the upper water table zone, the aquiclude and the confined aquifer.

241.10 (SRP 2.5.4) Please identify the wells/piezometers that are to be measured as part of the groundwater monitoring program (Page 2.5.4-23) during years of plant operation. Provide the pertinent information for these wells/piezometers (top and bottom elevations, type, typical installation details, etc.) and discuss the monitoring program requirements and objectives (frequency of readings, expected range of piezometric levels, field controls, etc.). Identify the controls to be required in technical specifications.

241.11 (SRP 2.5.4) Compare the results of your field geophysical surveys and laboratory strain-controlled dynamic triaxial testing with the adopted curves of strain dependent shear modulus and damping ratios (Figures 3.7.B.2-5 thru 3.7.B.2-7 and Figures 3.7.B.1-8 thru 3.7.B.1-10) for the compacted backfill, clay marl and lower sand layer which were used in your soil-structure interaction analysis. Discuss the bases for your selection of the adopted curves. In view of the wide range in engineering properties exhibited by the foundation materials (Table 2.5.4-1), indicate what reasonably conservative variations in dynamic soil properties were used in soil-structure interaction studies.

241.12 (SRP 2.5.4) Provide the input values to permit the Staff to verify that you have used a consistent set of soil properties and soil profiles below plant grade in your finite-element and lumped parameter studies. Your description of techniques used to obtain the impedance functions for layered medium, provided in the Appendix 3E of the FSAR, is inadequate. Give the depth of soil profile and values of soil parameters you considered while using this approach. Provide design assumptions and sufficient details of your calculative procedures and results to justify your proper use of soil stiffnesses and damping values for soil springs used in your lumped-parameter analysis.

241.13 (SRP 2.5.4) Although the depth to bedrock below the plant finished grade is approximately 950 ft., your soil-structure interaction model uses a 219 ft depth of soil thickness (Figures 3.7.B.2-3 and 3.7.B.2-4). Provide details of your assumptions and justify the basis for selecting this depth of soil.

241.14 (SRP 2.5.4) Provide the values of Category I backfill properties used in the seismic analysis of the underground piping and conduits. Explain and reference your procedure for calculating dynamic axial and bending stresses including the seismic input used for this analysis. Verify that you have adequately accounted for the effect of reasonable variations in soil properties in your analysis.

241.15 (SRP 2.5.4) Sufficient information and details for the foundation design under static and dynamic loading has not been provided for seismic Category 1 tunnels, water storage tanks and the Diesel Fuel Oil Storage Tank Pumphouses. This information is needed along with the engineering soil properties adopted in foundation design with the supporting basis for that selection.

241.16 (SRP 2.5.4) Please provide an explanation on how the range of estimated total settlements shown on Figure 2.5.4-8 was established.

241.17 (SRP 2.5.4) The FSAR does not provide any records of actual settlements measured to date. Provide up-to-date plots of settlement versus time for seismic Category 1 structures. These plots should also reflect significant contruction activities (foundation excavation and heave, dewatering events, magnitude of structure loading stresses, etc.) in order to permit an understanding of the effect of these activities on settlement behavior and structure performance.

241.18 (SRP 2.5.4) Discuss and compare total and differential settlement allowed for in design with actual settlement records at specific structure and buried piping locations. Provide sufficient plan and sectional views of involved structures and buried piping as needed for meaningful discussion and comparison. Provide a table of maximum stresses for the required loading combinations that includes information indicating the magnitude of stresses induced by differential settlements as allowed for in design.

241.19 (SRP 2.5.4) Provide sufficient information and details (specific locations, frequency of readings, allowable settlement limits, etc.) to permit an evaluation of the settlement monitoring program to be required during years of plant operation. Identify the controls (e.g. allowable limits) and criteria to be required in the technical specifications for seismic Category 1 structures and piping.

241.20 (SRP 2.5.4) The discussions and information provided on caisson foundation design (Section 2.5.4.10.3) should be expanded to include description of actual field installation (layout, typical sectional views, method for drilling and casing, results of down-the-hole inspection, placement procedures, etc.) and any construction problems encountered and actual settlement versus time plots. Provide a description of the seismic analysis completed on this caisson supported foundation with adopted dynamic soil and caisson properties and include response estimates to demonstrate an adequate safety margin is available for foundation stability under SSE loading conditions.

241.21 (SRP 2.5.4) Paragraph 2.5.4.10.5 is inadequate in describing the design procedures used to establish lateral earth pressures. Provide a detailed discussion covering all seismic Category 1 structures on the procedures used in design to determine passive earth pressures and dynamic earth pressures and include supporting pressure diagrams and actual soil parameters adopted in design with the basis for selection. Give the values of soil friction used in studies of sliding resistance and present, in tabular form, the calculated factors of safety against overturning, sliding and flotation for all seismic Category 1 structures for applicable loading combinations.

241.22 (SRP 2.5.4) There is insufficient information in Section 2.5.4.14 of the FSAR which documents the actual field work completed to repair the eroded areas of Category 1 backfill (November 1979). Describe the actual field procedures and activities performed to establish the extent of disturbed soil backfill in the eroded areas. Provide the results of field and laboratory tests which were completed to verify the competency of the unaffected fill. Identify with supporting figures the extent of repair excavations (grades, limits and slopes) and describe backfill operations including working space limitations. Describe procedures used to overcome these limitations. Define the limits (areal and depth) where mounds of loosely placed temporary fill were placed to prevent further seepage and erosion after the 1979 incident. Describe the steps taken to remove and backfill these areas. Describe future monitoring planned to demonstrate the adequacy of the completed repair work.

241.23 (SRP 2.5.4) Describe the measures taken to assure foundation stability of affected safety related structures and piping in the areas subjected to extensive excavation slope slumping and riprap placement (Page 2.5.1-24). Coordinate this discussion with the limits identified in the requested plan in question Q241.2 item 4.

Enclosure 2

Vogtle Electric Generating Plant, Units 1 and 2
Docket Nos. 50-424/425

Subject: Referenced FSAR reports required for completion of geotechnical engineering safety review

Required Reference No. and Title	Page Identifying Reference
No. 64, "Report of Marl Investigation: December 1974	2.5.1-45
No. 65, "Report on Stratigraphic Irregularities Exposed in Auxiliary Building Excavation" February 1978	2.5.1-46
No. 66, "Report of Geology and Foundation Conditions, Power Block Area" September 1979	2.5.1-46
No. 7, "Test Fill Program, Phase II" October 1978	2.5.4-35
No. 15, "Final Report on Dewatering and Repair in Category 1 Backfill in Power Block Area" August 15, 1980.	2.5.4-36
No. 16 Letter from C. J. Dunnicliff to J. D. Duffin October 12, 1977	2.5.4-36

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 28 1983

Docket Nos.: 50-424
and 50-425

Mr. Donald O. Foster
Vice President and Project Manager
Georgia Power Company
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Dear Mr. Foster:

Subject: Vogtle FSAR Conformance to the SRP Rule

This letter provides clarification of a question contained in our September 6, 1983 letter to you. In Enclosure 2 to that letter, we indicated that FSAR sections referenced in FSAR Table 1.8-1 do not provide an adequate evaluation of differences with the Standard Review Plan (SRP) as required by 10 CFR 50.34(g). These FSAR sections do not provide a discussion of the SRP acceptance criteria, of how the proposed alternative differs from the SRP, or of how the proposed alternative adequately complies with NRC regulations which form the basis of the corresponding acceptance criteria. In addition, several of the listed sections are incorrect references. As indicated in our September 6 letter, these deficiencies should be corrected within 60 days of docketing the Vogtle FSAR.

While the regulation does not prescribe any one particular method of complying, the preferred format should contain a specific subsection devoted to describing SRP differences in each FSAR section where such differences exist. Your FSAR Table 1.8-1 would provide a summary of the differences and the location of the more detailed discussions in the text. Therefore, Table 1.8-1 could remain as is except for the incorrect references.

Sincerely,

Thomas M. Novak, Assistant Director
for Licensing
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cc: See next page

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VOGTLE

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