September 17, 2004

Mr. William A. Eaton, Vice President
System Energy Resources, Inc.
Entergy Nuclear, M-ECH-38
1340 Echelon Parkway
Jackson, MS 39213

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 5 - SYSTEM ENERGY RESOURCES, INC., EARLY SITE PERMIT APPLICATION FOR THE GRAND GULF ESP SITE (TAC NO. MC1378)

Dear Mr. Eaton:

By letter dated October 16, 2003, System Energy Resources, Inc., (SERI) submitted its application for an early site permit (ESP) for the Grand Gulf ESP site.

The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of the Site Safety Analysis Report (SSAR) in your ESP application. The NRC staff has determined that additional information is necessary to continue the review. The topic covered in the requests for additional information (RAIs) contained in Enclosure 1 are seismology and geology information. These RAIs were sent to you via electronic mail on August 11, 2004, and were discussed with your staff during the site visit on August 25, 2004.

Receipt of the requested information within 75 days of the date of this letter will support the NRC's efficient and timely review of SERI's ESP application. Please note that failure to provide a response in a timely fashion may result in a delay of completion of the staff's safety evaluation report.

If you have any questions or comments concerning this matter, you may contact me at (301) 415-1146 or rka@nrc.gov.

Sincerely,

/RA/

Raj K. Anand, Grand Gulf ESP Project Manager
New Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 52-009

Enclosure: As stated

cc: See next page

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Grand Gulf ESP Application
Site Safety Analysis Report (SSAR)
Requests for Additional Information (RAIs)

SSAR Section 2.5, Geology, Seismology, and Geotechnical Engineering

RAI 2.5.1-1

SSAR Figure 2.5-5 only shows seismicity down to Mb 3.3 and this low-magnitude cut off is cited several times in SSAR Sections 2.5.1 and 2.5.2. Please comment on whether this low-magnitude cutoff resulted in excluding seismicity along the Gulf Coast in Louisiana and an Mb 3.0 earthquake west of Jackson, Mississippi in 1927 as part of your seismic hazard characterization. Also, the 1927 Jackson, Mississippi earthquake, listed as Mb 3.4 in the U.S. Geological Survey (USGS) national seismic hazard map catalog, is not shown on SSAR Figure 2.5-5. Please provide an explanation for this omission.

RAI 2.5.1-2

SSAR Section 2.5.1.1.6 on regional seismicity makes the statement, “This low rate of activity has characterized the seismicity of the Gulf Plain for over 150 years, and most likely throughout the Quaternary,” at the end of the second paragraph. Please provide the scientific evidence for extending the last 150 years of seismicity to the whole Quaternary.

RAI 2.5.1-3

SSAR 2.5.1.1.5.9 describes the Saline River source zone and the geologic and paleo-liquefaction evidence for it, as summarized chiefly in Reference 152 (Cox, 2003) and in Cox (2004 published in the June issue of the Bull. Seism. Soc. Am., and cited in Reference 152 but not cited directly in the SSAR).

1. Please clarify whether the SSAR was based on Cox (2003), a preprint of Cox (2004), or both.

2. Reference 152 is a Final Contract Report by Cox to the USGS. However, there are two Final Contract Reports by Cox, and their references are identical except that one has a 2001 date and a 2001 contract number, whereas the other has a 2003 date and contract number. SSAR 2.5.7 lists Reference 152 with the 2003 date. Please confirm which Final Contract Report is referenced in SSAR 2.5.7.

3. Please explain the degree to which the latest findings of Cox (2004, BSSA) are consistent with the characterization of the Saline River source zone in SSAR 2.5.2.1.3 and Table 2.5-46.

4. Cox (2003, 2004) estimated the sizes of the prehistoric earthquakes that created the liquefaction features as approximately M 5.7-6.0. Cox measured the long diameters of two liquefaction fields and applied the Ambraseys relation between the most distant observed liquefaction and magnitude. SSAR 2.5.2.1.3.3 explains why the earthquakes were probably not much more than 0.5 M units larger than Cox’s estimates. However, the sand that blows in Cox’s trenches are thick and wide, much larger than one would expect of the most distant observed liquefaction. Additionally, the large sand blows exposed in all trenches published

so far (Golden, Kelso, Morgan, Montrose, and Portland sites) are at or close to the edges of their liquefaction fields. Please explain, quantitatively if data allows, whether or not the large sizes of the sand blows are consistent with the moderate estimated magnitudes.

5. SSAR 2.5.1.1.5.9.3 and Tables 2.5-5 and 2.5-6 provide the characterization of the Saline River source zone. Regarding this SSAR Section and Tables: (1) please explain whether the minimum and maximum event dates are ±1 or 2 standard deviations; (2) distinguish between conclusions or values taken directly from Cox (2003) and inferences drawn from this source; (3) please explain the source of Table 2.5-5 as the heading of Table 2.5-5 states “Modified from Cox (2003)”, whereas neither Reference 152, Cox (2004), nor any of Cox’s three previous contract reports to the USGS contain anything like the table; (4) provide the reasoning or assumptions for the values listed in Table 2.5-5 and 2.5-6; and (5) provide a link between the events listed in SSAR 2.5.1.1.5.9.3 and in Table 2.5-5.

6. Reference 152 describes observations from new trenches at the Morgan and Golden sites, but these results could not be integrated into Cox (2003, 2004) or the SSAR because the event dates were not expected until July, 2004. Please explain whether the dates and conclusions based on them are yet available. Please also explain whether or not these new results alter any aspects of the characterization of the Saline River source zone.

<u>RAI 2.5.1-4</u>

Section 2.5.1.1.5.9 describes scenarios for the palco-liquefaction features discovered in the Saline River Source Zone. One of the scenarios is to attribute these sandblows to the 1811-12 New Madrid earthquakes. Based on this scenario, the sandblow distribution of the 1811-12 New Madrid earthquakes would extend farther south at least 175 Km away from the previously recognized 1811-12 sandblow distribution. Since the magnitudes of the 1811-12 New Madrid earthquakes were estimated partially based on the areal distribution of the liquefaction sandblows, what is the impact of this areal expansion to the estimated magnitudes of the 1811-12 earthquakes and the seismic hazard characterization of the ESP site?

<u>RAI 2.5.2-1</u>

The SSAR at the end of Section 2.5.2, refers to three engineering reports (ER-01, ER-02, and CP-01). One of the reports (CP-01) is not cited in the references at the end of the entire SSAR Section 2.5. Please add a citation to this report to the reference list and provide a copy of the report so that the reviewers can better understand how the detailed site response calculations were done.

<u>RAI 2.5.2-2</u>

SSAR Section 2.5.2.1.2.4 discusses and applies a moment-rate constraint on New Madrid M7+ earthquakes from geodetic data. The use of moment-rate constraints in the probabilistic seismic hazard assessment (PSHA) is common in California and near other plate boundary locations. However, in the Central and Eastern United States (CEUS) and the New Madrid seismic zone (NMSZ) in particular, the physical mechanism behind the occurrence of M7+ events at a rate much higher than strain accumulation is not scientifically understood. The paleoseismic evidence convincingly supports a 500-year mean recurrence interval for M7+ New Madrid events while the geodetic data, although somewhat equivocal, does not support such high moment rates. Viscous element models, such as Kenner and Segall, 2000 (Science, v 289, 2329-2332), have been proposed to allow high moment release in earthquakes over short geologic time intervals without high rates of stress accumulation.

1. In view of uncertainties of the physical mechanism behind CEUS M7 earthquakes, please provide a justification for applying a moment rate constraint for the modeling of these earthquakes.

2. A constant shear modulus of 3.5×10^{11} dyne/cm^2 is used in the seismic moment rate calculations of this section. Please describe the impact of allowing for ruptures into the lower crust, where shear velocities and hence shear moduli are higher than the shallow crustal values of California.

3. The moment-rate constraint uses rupture-area estimates from the Reelfoot fault. Rupture area is the product of rupture length and down dip width. The length may be well constrained but the width of the Reelfoot and other NMSZ faults is not. Width is often taken to match the down dip extent of instrumental seismicity, which extends to a depth of 12-14 km on the Reelfoot fault. However, Johnston, 1996 (Geophys. J. Int., V 126, p 314-344) and the main shock rupture of the 2001 M 7.6 Bhuj intraplate earthquake suggests that major fault ruptures can occur down into the lower crust. Please explain and justify the assumptions and reasoning leading to an estimated rupture area of 1300 km^2 for a rupture of the Reelfoot fault (Table 2.5-13).

<u>RAI 2.5.2-3</u>

SSAR Section 2.5.2.2.2 provides a brief statement that the Electric Power Research Institute (EPRI) SOG's a- and b-values were converted from Mb to Mw for the hazard calculations. Please provide the details of the steps and equations employed in this conversion so that the staff can evaluate their validity. Also, provide the details of where in the hazard calculation this conversion is performed.

<u>RAI 2.5.2-4</u>

Figure 2.5-47 of the SSAR for Grand Gulf shows the estimated rate of earthquakes of magnitudes from 5 to 6 using the Electric Power Research Institute/Seismic Owners Group (EPRI/SOG) and updated catalogs. This figure's vertical axis is labeled frequency of exceedance per year. Does a point at magnitude 5 correspond to the mean annual frequency of magnitude 5 and above, or magnitude 5.1 and above, or to some other rate of earthquakes? In addition, what b-value or range of b-values were used to generate the curves in this figure?

<u>RAI 2.5.2-5</u>

In characterizing the seismic hazard of the New Madrid seismic source zone, SSAR 2.5.1.1.5.6, 2.5.2.1.2.2, and Table 2.5-10) cite the preferred magnitudes of Bakun and Hopper (2003, in press) for the New Madrid main shocks of 1811-12 as Mw 7.2, 7.1, and 7.4. The work of Bakun and Hopper (2003, in press; Reference 115) has been withdrawn and revised with corrected magnitude estimates for the 1811-12 New Madrid main shocks as M 7.6, 7.5, and 7.8 (Bakun and Hooper, 2004, Bull. Seism. Soc. Am., v. 94, no. 1, p. 64-75).

1. Please explain what changes these revised magnitude estimates may require in the analysis and provide corrected copies of any affected tables and figures.

2. Please quantify the effect of the revised magnitude estimates on hazard at the site by providing a graph showing two long-period (ca. 1 Hz) hazard curves, one using the magnitudes of Bakun and Hopper (2003, in press) and the second using the magnitudes of Bakun and Hopper (2004). Other parameters should be held constant for both curves and the curves should extend to an annual probability at least as small as 10^{-5}.

RAI 2.5.2-6

SSAR 2.5.2.1.1 and Table 2.5-8 summarize maximum magnitudes (Mw(max)) and fractional weights developed by the six EPRI Earth Science Teams (ESTs) as part of the 1986 EPRI-SOG Project (Reference 9) for the seismic source zones surrounding the ESP site. In consideration of the 1994 EPRI study of Arch Johnston, “Seismotectonic Interpretation and Conclusion from the Stable Continental Region Seismicity Database,” please provide a justification for not updating the EPRI EST seismic source characterizations to give more weight to larger magnitude earthquakes.

RAI 2.5.2-7

SSAR 2.5.2.1.3 characterizes the Saline River source zone, and Table 2.5-13 describes the calculation of recurrence intervals for characteristic earthquakes in the zone. Both parts of the SSAR list preferred slip rates of 0.01, 0.05, and 0.10 mm/yr, and the table assigns weights of 0.6 to the recurrence estimates calculated from slip rates of 0.05 mm/yr. The slip rates are vertical rates for which incision rates of uplifted terraces are taken as proxies (Fig. 2.5-23, SSAR 2.5.1.1.5.9.1). However, the incision rates are 0.05-0.09 mm/yr for a surface of age 800-1300 ka, 0.3-0.5 mm/yr for a younger surface 70-120 ka, and 0.8-1.7 mm/yr for the youngest surface 18-30 ka. SSAR 2.5.1.1.5.9.1 mentions no reason to prefer one of these incision rates over another. However, younger surfaces with offsets large enough to be the result of multiple earthquakes may be the better estimators of current and near-future slip rates. Please explain the evidence and reasoning that led to a choice of slip rates that are centered around the lowest of the measured incision rates (0.05 mm/yr).

RAI 2.5.2-8

SSAR Figures 2.5-48 through 2.5-54 show hazard curves for 0.5 Hz, 1 Hz, 2.5 Hz, 5 Hz, 10 Hz, and 25 Hz Sa. In each figure, the mean curve is shown above or approximately coinciding with the 0.85 fractile curve for higher spectral accelerations. Please explain this asymmetry.

RAI 2.5.2-9

SSAR 2.5.2.2.5.1 and Figures 2.5-57 and 2.5-58 describe the deaggregation results. The Saline River source zone is 130-330 km distant from the site (Figure 2.5-19) and is presumed to have earthquakes as large as 6.0-7.0 (SSAR 2.5.2.1.3.3). However, those distance and magnitude bins make no contributions to the deaggregation graphs. Please explain this apparent discrepancy.

RAI 2.5.2-10

SSAR 2.5.2.2.5.2 and Table 2.5-16 describe the computed controlling earthquakes for low and high frequencies (1-2.5 Hz and 5-10 Hz, respectively). The table lists the controlling earthquake for high frequencies to be M 6.3 at 82 km from the site. However, the high frequency deaggregation graph (Figure 2.5-58) shows no contribution from the magnitude-distance bin that contains the controlling earthquake. Please explain this discrepancy.

RAI 2.5.2-11

Section 2.5.2.3 indicates that Approach 2A was used to generate the soil uniform hazard spectrum (UHS) corresponding to the defined hardrock UHS, following the procedures of NUREG/CR-6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard and Risk Consistent Ground Motions Spectra Guidelines." The procedure generally recommended in NUREG/CR-6728 for deep soil sites is Approach 2B and is the method that has been used to generate design spectra at the ground surface at a number of other soil sites. Please provide the basis for using Approach 2A as opposed to what is generally regarded as the more appropriate method 2B.

RAI 2.5.2-12

Section 2.5.2.5 describes the resulting soil UHS developed from the site response calculations corresponding to the given rock UHS. This spectrum is shown in Figure 2.5-67 and is indicated to have a spectral acceleration at 100 Hz of about 0.2g. The corresponding vertical spectrum is developed for the ESP site by using the vertical-to-horizontal (V/H) ratios generated from the Regulatory Guide (RG) 1.60 criteria spectra. What is the basis for this selection and how does it compare with more recent recommendations for V/H ratios available in the literature?

RAI 2.5.4-1

Section 2.5.4.1.2 presents a general description of the soil profile at the site.
Section 2.5.4.1.3.4 describes the Catahoula formation as hard clay and claystone.
Section 2.5.4.1.2 and Sections 3.2 and 10.4 of Environmental Report (ER)-02 indicate that this material is Miocene in age, is often referred to as "bedrock," and is labeled as the primary load-bearing component for safety-related facilities. The Miocene deposits are described in Section 2.5.1.1.4.2.3.2 of the SSAR as a succession of clays and sandy clays interspersed with lens of fine sands, sandstone and gravels that extend to great depths throughout the Gulf region.

Only three new borings were taken at the site since Borings 2 and 2A are essentially at the same location and no samples were taken in Boring 2A over the depth range covered by Boring 2. Of the new borings, only one (Boring 2A) reached to the depth of the Catahoula and in this boring, no continuous core is indicated to have been taken in this material. The section goes on to indicate that the descriptions of the profile in the previous updated final safety analysis report (UFSAR) have been improperly categorized as members of the Catahoula formation. With only one boring available and no significant samples taken in this formation, what is the basis for categorizing this relatively shallow component of the deep profile as bedrock as opposed to dense sands and gravels? What is the impact of describing this formation as "bedrock" as opposed to dense sands and gravels in the various site evaluations?

<u>RAI 2.5.4-2</u>

Section 2.5.4.1.2 indicates that the ESP area includes cut and fill sections. The fill is of variable thickness and was indicated to have been placed to fill the various swales that cross the site. What is known about the character of the fill material and what controls, if any, were placed at the time of their deposition?

<u>RAI 2.5.4-3</u>

Section 2.5.4.1.1 indicates that four new borings and four cone penetrometers were installed to characterize the ESP area. It should be noted that actually only three borings are available for the site since borings 2 and 2A are essentially at the same location and no samples were recovered in 2A over the depth of Boring 2. The maximum depth investigated during this program is indicated to be about 240 feet. In the soil profiles developed for the site (Figs. 2.5-30 and 31), the descriptions developed from previously available site investigations were included. How many of the original borings were evaluated in characterizing the ESP site area and what was their maximum depth of investigation? Presuming that these borings are also relatively shallow, and that the site profile used in the site response analyses described in Section 2.5.2.3 extends down to thousands of feet above the relatively hard rock where the PSHA is defined, what additional information is available for the Grand Gulf Nuclear Station (GGNS) site to allow characterization to the deeper depths required for the site response?

<u>RAI 2.5.4-4</u>

The site velocity profile used in the response calculations makes use of the site specific soil profile described in Section 2.5.4.1 developed from the site data extending down to a depth about 225 feet. The description provided in Section 2.5.2.3 indicates that this profile was then placed upon a generic shear wave model for the Mississippi embayment. Most other sites housing critical facilities and using the probabilistic method of NUREG/CR-6728 to generate soil surface ultimate heat sink (UHS) attempt to develop one or more base case site velocity models from site specific data available from other information (such as well logs, deep borings, etc). What is the basis for selecting this generic base case velocity model over any other model that may be generated from available information for the site and its environs?

<u>RAI 2.5.4-5</u>

Section 2.5.4.1.3 and Sections 7.0 and 8.0 of ER-02 present descriptions of shear wave velocity properties for the various layers of the shallow profile. To perform the probabilistic site response calculations, the base case (best estimate, BE) velocity profile is used, together with upper and lower bound (UB and LB) shear wave velocity values over the entire soil profile. What were the values of the BE, UB and LB velocities selected for each primary component of the profile and what were the bases for their selection? Were these values used in the site response calculations described in Section 2.5.2.3?

RAI 2.5.4-6

Section 2.5.4.1.7 indicates that the shear modulus reduction and hysteretic damping models used in the site response calculations were the EPRI93 depth dependent curves. These are generally considered appropriate for normally consolidated cohesionless sands. As described in Sections 11.0 and 12.0 of ER-02, these curves may not be appropriate even for the near-surface layers of the profile for which laboratory data is available. They also may not be appropriate for any gravelly layers in the profile which tend to behave significantly more nonlinearly than indicated by the EPRI93 set. What is the basis for the selection of the EPRI93 curves as opposed to other models that may be more appropriate based on site specific information described in the geotechnical report?

RAI 2.5.4-7

Sections 2.5.4.1.7 together with Section 11.0 and Appendix G of ER-02 present a detailed presentation of the laboratory dynamic test results. The shear modulus reduction and hysteretic damping curves generated from the laboratory testing are compared with the recommendations for cohesionless sands generated during the EPRI93 study. The shear modulus data presented in Appendix G for samples taken from a shallow depth are indicated to be reasonably comparable to the EPRI recommendations for deep depths of 500 feet to 1,000 feet. The laboratory results for hysteretic damping are also much lower than indicated from the EPRI study for comparable depths. Section 11.0 of ER-02 indicates that although the data are similar to the EPRI recommendations, they are much more linear and possess lower damping. Comparison of the low amplitude velocity test data with field measurements indicate that some sample disturbance may have occurred. Section 11.0 of ER-02 goes on to suggest a method to correct the measured data for use in the site response calculations. In addition, some parts of the soil profile are indicated in the boring logs of Appendix C of ER-02 to have significant gravel content. These materials would therefore normally be expected to be much more nonlinear than the EPRI93 recommendations. Section 2.5.2 of the SSAR indicates that the EPRI93 model was used for all layers of the deep profile. What is basis for not incorporating these effects in the site response calculations and what could be the potential impact of these modifications on the computed surface UHS?

RAI 2.5.4-8

Section 2.5.4.1.3 of the SSAR presents summary velocity properties for the various layers of the shallow soil profile. Section 7.7.1 of ER-02 indicates that the loess has a shear wave velocity that ranges from 800 to 900 feet per second (fps). The borehole logger data of Appendix D shows values as low as 600 fps. Table ER-02-4 indicates values that range from about 600 fps to over 1400 fps. The best estimate (or mean value?) is indicated in Section 8.2 of ER-02 to be 770 fps. How do these values of shear wave velocity compare with the best estimate, upper bound and lower bound values used in the site response calculations? Why are the mean values of velocity for all the material layers not approximately centered on the ranges listed in Table 8.2?

RAI 2.5.4-9

Section 2.5.4.3 indicates that the site is stable and will not be prone to dynamically induced failures. Section 3.3 of ER-02 indicates that the site does not show any indications of dissolution cavities or sinkholes. The general descriptions of the site presented in Section 2.5.1.2.3.1.2.3 of the SSAR indicate that calcareous clays, limestone and marl formations underlay the site profile and may even be exposed in the site vicinity. None of the borings shown in the section profiles (old or new) reach to these depths. Such materials are often susceptible to such problems. What is the basis for indicating that this site is not susceptible to such potential long-term problems?

RAI 2.5.4-10

Section 2.5.4.5.2 of the SSAR indicates that several inches of elastic rebound may be associated with the site excavations planned to relatively deep depths and that this rebound would be expected to be reversible, presuming the new structures are fully compensated designs. Presuming that the current GGNS power block structures are far enough from the ESP site, are any other facilities (piping, conduit, etc.) existing in the ESP area that may be influenced by such surface movements?

RAI 2.5.4-11

Section 3.3 of ER-02 indicates that all safety related facilities located at the ESP site would be located on alluvium or old alluvium that has an average shear wave velocity of "at least 1,000 fps". The suspension logging data provided in Appendix D indicates measured shear wave velocities as low as 500 fps at depths of up to 120 feet (see results for Boring B-1, for example). This depth is well below the planned depth of foundations indicated in the SSAR. Since measured shear wave velocities are based on the results from only three borings, and considering the normal variability anticipated in shear wave velocity, what would the impact of such a velocity cutoff have on the minimum depth for future siting, especially since some of the advanced reactor designs may be qualified for velocities of at least 1,000 fps?

RAI 2.5.4-12

Section 2.5.4.1.3 of the SSAR and Section 7.5 of ER-02 indicate that the difference in blow counts for the standard penetration test (SPT) between previous field programs and the current program performed for the ESP may be due to a difference in hammer equipment used for the samples. Since only three borings were taken for the ESP program and since conclusions for this evaluation rely heavily on the previous site investigations, was any simple program performed to quantify this difference (such as taking a new boring adjacent to an old boring using the new equipment)?

RAI 2.5.4-13

Section 2.5.4.1.6 indicates that samples were shipped to the University of Texas by automobile and to Eustis by Federal Express. The UTexas description included in Appendix G of ER-02 indicates that all samples examined for dynamic testing had the appearance of competent, intact materials. Section 11.0 of ER-02 indicates that samples were carefully extracted from the borehole and presumably carefully shipped to UTexas. Yet, the report indicates that the results of the dynamic testing indicate some effect of sample disturbance. What measures were taken, if any, aside from these qualitative statements, to ascertain whether any significant disturbance occurred during the sampling, transportation or laboratory extrusion process? Since the static testing program included consolidated undrained (CU) triaxial tests, was any concern expressed about disturbance to these samples as well?

RAI 2.5.4-14

Appendix D of ER-02 presents the results of the P-S Borehole Logging that was conducted by GeoVision in the three boreholes. From this data, P-wave and S-wave profiles were generated to depths of from about 180 feet to 225 feet.

1. Page 7 of this Appendix presents the assessment that the "shear wave data was of excellent quality in the three boreholes". What is the basis for this judgment? Does the fact that the statement only refers to the quality of the S-wave data imply that the P-wave profiles are of lower quality?

2. The plots of P-wave velocity with depth show the relatively rapid increase one would normally expect near the ground water table. The results from Borings 1 and 3 show this characteristic velocity increase. However, the results for Boring B-2A show the characteristic rise followed by a significant reduction at a depth of approximately 70 feet. What is the cause of this anomaly?

RAI-2.5.4-15

Appendix F of ER-02 presents the results of standard geotechnical identification tests as well as some results from CU triaxial strength tests.

1. The sample descriptors provided with the grain size distribution curves present descriptions such as "FINE SAND w/Silt" (see, for example, B1-S22 as well as others) for cases where the sample contains less than 10 percent fines. Can such descriptors mislead evaluations based on verbal descriptions?

2. The tables also include unified soil classification (USC) descriptors such as lean clay or silt (CL or ML) for samples for which no Atterberg Limits were determined. For these cases, what was the basis for developing such classifications?

3. For some samples, only one CU test was performed from which estimates of strength parameters (cohesion and friction angle) are listed. What was the basis of such judgments?

RAI 2.5.4-16

Appendix G of ER-02 presents the results of dynamic laboratory testing conducted by the University of Texas on six intact samples obtained from borings B-1, B-2 and B-3 taken at the ESP site. The purpose of the tests was to evaluate the linear and nonlinear shear modulus and material damping characteristics of the samples. The dynamic laboratory tests included both Resonant Column (RC) and Torsional Shear (TS) conducted at different confining pressures and maximum strain levels. The samples tested were all fine-grained soil samples, four having low plasticity indices (PIs) (less than 5 percent) and two having more plasticity (PI = 12-13 percent). Table 3 of Appendix G (as well as Table ER-02-6) of the body of the report indicates that three of the samples were confined at pressures based on an assumed value of K_o of 0.5 and three were tested at an assumed value of 1.0. What was the basis of these selections and how did the resulting pressures compare with current estimated in-situ stress levels?

RAI 2.5.5-1

Section 2.5.5 of the SSAR and Sections 3.3 and 12.5.2 of ER-02 indicate that the west-side of the proposed ESP site is bounded by a 60-foot to 70 foot escarpment that may be subjected to surficial slumps and potential creep of the loess soils. They go on to indicate that since future safety related facilities would be founded on alluvium or old alluvium encountered below the loess, future movements of the slope should not have any significant impact on these foundations. However, if such facilities would be founded close to the scarp, such slump or creep effects could have an impact on lateral loads applied to such deeply founded facilities. Was any evaluation performed to indicate the expected behavior of the loess escarpment or the extent to which such movements could occur? Should the potential site area therefore contain some exclusionary zone along the west-side boundary that would not be susceptible to such potential future slump?

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