RAS 12609

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OFFICE OF SECRETARY
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of	)	
	)	
SYSTEM ENERGY RESOURCES, INC.	)	Docket No. 52-009-ESP
	)	
(Early Site Permit for Grand Gulf ESP Site)	)	ASLBP No. 04-823-03-ESP

PRE-FILED TESTIMONY OF WILLIAM R. LETTIS AND JEFFREY L. BACHHUBER ON BEHALF OF APPLICANT CONCERNING HEARING ISSUE D (SLOPE AND FOUNDATION STABILITY)

Q1. Please state your name, current position, and by whom you are employed.

A1. My name is William R. Lettis ("WRL"). I am employed as the President and Principal Geologist of William Lettis & Associates, Inc.

A1. My name is Jeffrey L. Bachhuber ("JLB"). I am employed as the Vice President, Senior Principal Engineering Geologist of William Lettis & Associates, Inc.

Q2. On whose behalf are you testifying in this proceeding?

A2. (WRL, JLB) We are providing testimony on behalf of the applicant in this early site permit ("ESP") proceeding, System Energy Resources, Inc. ("SERI" or the "Applicant").

Q3. Please describe your professional qualifications.

A3. (WRL) I hold a Ph.D. and an M.S degree in Geology from the University of California, Berkeley, and a B.S. degree in Geology and a B.S. degree in Forestry from Humboldt State University. I have over 20 years of experience performing regional and site investigations to assess geologic and seismic hazards for large engineered facilities, including bridges, dams, nuclear and fossil fuel plants, pipelines, and Liquid Natural Gas ("LNG") terminals. A full statement of my professional qualifications is contained in SERI Exhibit 1.

Template = SECY-055

SECY-02

A3. (JLB) I hold M.S. and B.A. degrees in Geology from San Jose State University. I am a Certified Engineering Geologist in California with over 20 years of professional experience performing geologic/geotechnical studies for nuclear and other critical facilities throughout the United States, Peru, Dominican Republic, Puerto Rico, Korea, Indonesia, Japan, and Turkey. I have performed detailed site investigations in a variety of geologic settings, in addition to regional hazard mapping and facility siting and routing studies. These projects involved assessment of earthquake hazard and sources, fault rupture and ground failure analysis, slope stability analysis and mitigation design, karst and void identification and treatment, foundation characterization with borings and geophysical techniques, laboratory testing, failure mode assessment, and development of foundation criteria for detailed static and dynamic stability and site response analyses (including soil-structure interaction) A full statement of my professional qualifications is contained in SERI Exhibit 1.

Q4. Please describe your professional responsibilities with regard to the Grand Gulf ESP application, including the basis for your familiarity with that application.

A4. (WRL) As Project Manager for the seismic and geotechnical work in support of the Entergy Grand Gulf Nuclear Station ("GGNS") ESP, my responsibilities included preparation of Sections of 2.5.1 through 2.5.6 of the Site Safety Analysis Report ("SSAR"), including seismic source characterization and probabilistic seismic hazard analysis used to develop the Safe Shutdown Earthquake ("SSE") design ground motion in compliance with Regulatory Guide 1.165, and geotechnical characterization of the site in partial compliance with Regulatory Guides 1.138 and 1.132.

A4. (JLB) I was responsible for developing detailed site geotechnical characterization for the Grand Gulf ESP site. My work regarding the Grand Gulf ESP included developing Quality Assurance/Quality Control ("QA/QC") technical procedures and workplans to guide all field and laboratory activities, as well as directing field investigations consisting of geologic mapping, deep mud rotary borings, cone penetrometer test ("CPT") soundings, borehole P-S velocity surveys, and SASW surface surveys. I also prepared Sections 2.5.4 to 2.5.6 for the Safety Analysis Report ("SAR"), responded to Nuclear Regulatory Commission ("NRC") Staff requests for additional information ("RAIs"), and presented the project to the Advisory Committee on Reactor Safeguards ("ACRS") in a formal meeting.

Q5. In an Order (Requesting Specific Summary Exhibits and Supplemental Briefs; Identifying Hearing Issues and Requesting Evidentiary Presentations on Specific Issues) of November 6, 2006, the Atomic Safety and Licensing Board ("Board") identified a series of hearing issues on which the Board has required testimony and presentations from the NRC Staff. The Staff submitted its pre-filed testimony on November 20, 2006. *See* NRC Staff Pre-Filed Testimony Concerning Hearing Issue D: "Slope and Foundation Stability" (Nov. 20, 2006). Have you reviewed the Staff's testimony on Hearing Issue D?

A5. (WRL, JLB) Yes.

Q6. During the October 31, 2006, pre-hearing conference, the Board expressly authorized the Applicant, as appropriate, to submit supplemental pre-filed testimony for the limited purpose of clarifying and/or providing additional factual information that may inform the Board's mandatory hearing review and decision-making process. *See* Transcript of October 31, 2006, Pre-hearing Conference at 8. Do you wish to provide any such supplemental testimony at this time?

A6. (WRL, JLB) Yes. We are offering supplemental testimony with respect to the following issues: river bluff stability, geologic nomenclature, foundation embedment depth, and shear wave velocity.

Q7. With respect to river bluff stability, please provide any additional information that you believe is necessary to address that issue.

A7. (JLB) In Hearing Issue D, Question Q.3 of the NRC Staff pre-filed testimony, the Board requested additional clarification regarding the geotechnical stability of the bearing strata and exterior earthern slopes (*i.e.*, bluff). The staff response discussed that the ESP setback ("stand-off") distance of 100 feet prevents potential failure surfaces through the bluff material from intersecting the plant cross-section. SERI Exhibits 3 and 5 provide a graphic representation of the relationships between the river bluff slope and ESP proposed plant reactor building envelope. This figure shows that the ESP setback distance provides a sufficient safety buffer against any reasonable potential failure surfaces from intersection of the proposed plant envelope. In order to reach the proposed plant envelope area, a failure plane extending from the river bluff would have an inclination significantly less than 15 degrees (above horizontal), which is far below typical estimated residual angles of internal friction (angle of repose) for the loess soil that forms the river bluff and typically stands vertically in excavated cuts.

Q8. With respect to geologic nomenclature, please provide any additional information that you believe is necessary to address that issue.

A8. (WRL) In Hearing Issue D, Question Q.4 of the NRC Staff pre-filed testimony, the Board requested additional clarification of the stratigraphic nomenclature used to describe the site geologic and hydrogeologic units. The Staff response provides clarification of the geologic stratigraphic nomenclature used in Section 2.5 of the SSAR, but does not provide clarification of the hydrogeologic nomenclature provided in Section 2.4 of the SSAR. The Staff's focus on the geologic unit nomenclature is appropriate, because Hearing Issue D relates to stability of the Mississippi River bluff, which is a geologic issue. However, to provide additional clarification, SERI Exhibit 4 provides a chart showing the correlation of geologic and hydrogeologic units used in the original site Updated Final Safety Analysis Report ("UFSAR") (in which some terms are now archaic), and those used in Section 2.4 (hydrogeologic units), and Section 2.5 (geologic units) of the ESP SSAR. The term "New Alluvium" cited in the Board question was not used in the ESP SSAR. It should be noted that the hydrogeologic nomenclature used in the original site UFSAR was adopted without change in the ESP. However, the geologic nomenclature used in the UFSAR was modified and updated in the ESP SSAR Section 2.5 to reflect more recent understanding of the geology in the Site Area.

Q9. With respect to plant foundation embedment depth and shear wave velocity, please provide any additional information that you believe is necessary to address that issue.

A9. (JLB) In Hearing Issue D, Questions Q.4, Q.5, Q.7, and Q.8 of the NRC Staff pre-filed testimony, the Staff discussed issues related to the depth of existing fill, plant foundation embedment depths, and minimum shear wave velocity requirements for plant foundation basemats. This response provides additional clarification regarding these issues.

Existing Fill

Existing fill underlying the ESP proposed reactor building envelope is localized and shallow (depth of fill above approximate elevation 100 feet; SERI Exhibit 3), and does not extend to the foundation depth ranges of planned power plants.

Foundation Depth

The Environmental Report plant parameters envelope (PPE; Table 3.0-1) lists the ESP bounding foundation embedment depth as 140 feet. This depth is the maximum depth of the bottom of the foundation basemat, as measured from the finished plant grade (assumed at approximately elevation 133 feet above mean sea level (MSL)) for any reactor design considered in the ESP Application. The relative location and elevation of this bounding depth with respect to the existing ground surface is shown on SSAR Figures 2.5-75 through 2.5-77 (*See* SERI Exhibit 3 for location of geologic cross sections A-A', B-B', and C-C'), and labeled as "likely maximum foundation depth range within Proposed PPBA" (Proposed Power Block Area). The corresponding elevation of this maximum bounding embedment depth is approximately elevation (-)7 feet MSL.

Other plant technologies considered in the ESP Application have basemat elevations that are shallower than the bounding embedment depth, typically within the range of about 30 to 70 feet below finished plant grade. The stability and foundation suitability of subsurface materials that occur between assumed finished plant grade and the bounding maximum foundation depth range (and below this depth range throughout the likely range of foundation influence) were specifically evaluated with respect to the varying technologies and possible embedment depths. This evaluation included compilation and review of about twenty existing borings from the Unit 1 UFSAR that are within and adjacent to the ESP reactor building envelope (See SERI Exhibit 3; SSAR Figure 2.5-69), drilling and sampling of three ESP borings, four ESP cone penetrometer soundings, seismic velocity surveys in the ESP borings, and laboratory static and dynamic testing of ESP borehole samples. On the basis of this evaluation, Section 2.5.4.6 of the SSAR recommends that the plant foundations be founded in Upland Complex alluvium at, or below, the bottom of loess deposits at approximately elevation 97 feet MSL (depth of 36 feet) or lower where the average shear wave velocity exceeds 1,000 feet per second and materials consist of dense alluvium.

Responses provided by NRC Staff in pre-filed testimony reference foundation embedment depths of between 120 and 140 feet (average depth of 130 feet). This depth correlates to the PPE bounding embedment depth for ESP foundations, rather than a minimum or design depth that could be at shallower depths according to the ESP evaluation.

Shear Wave Velocity

Some plant designs considered in the ESP Application reference a minimum 1,000 feet-per-second ("fps") shear wave velocity ("Vs") requirement for soils below the safety-related plant foundation basemat. Shear wave measurements of site subsurface materials were obtained by borehole P-S suspension surveys in each of the three ESP borings distributed within the proposed reactor building envelope (SSAR Figure 2.5-80). Based on the results from the ESP velocity surveys, Section 2.5.4.6 of the SSAR states that the average Vs exceeds 1,000 fps (in Upland Complex Alluvium) at, and below, approximately elevation 97 feet MSL (depth of about 36 feet below assumed finished plant grade elevation 133 feet MSL). Plant basemat (foundation) elevations above this level would require overexcavation of soils down to material exhibiting an average shear wave velocity of 1,000 fps, or alternatively in-situ improvement (*e.g.* grouting). Excavated soils would be replaced with engineered fill (*e.g.*, lean concrete) that exhibits an average Vs of 1,000 fps or greater.

The shear wave velocity criteria and foundation engineering approaches presented in the ESP SSAR permit plant foundation basemat embedment in Upland Complex alluvium at depths substantially less than the depth range of 120 to 140 feet referenced by the NRC staff in their responses.

Q10. Does this conclude your testimony?

A10. (WRL, JLB) Yes.

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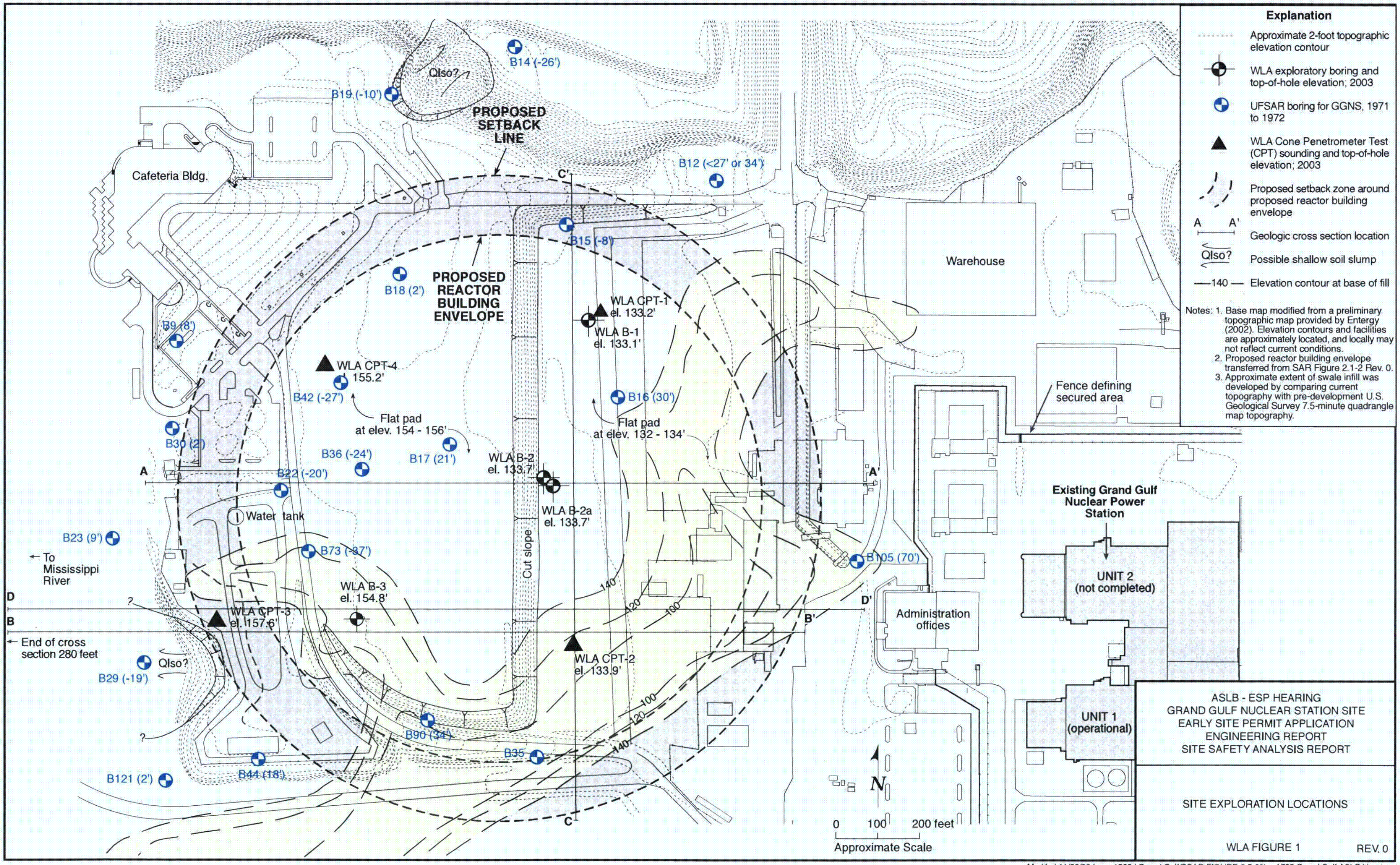


Modifed 11/22/06 from: 1522d Grand Gulf/SSAR FIGURE 2.5-69b 1785 Grand Gulf ASLB Hearings

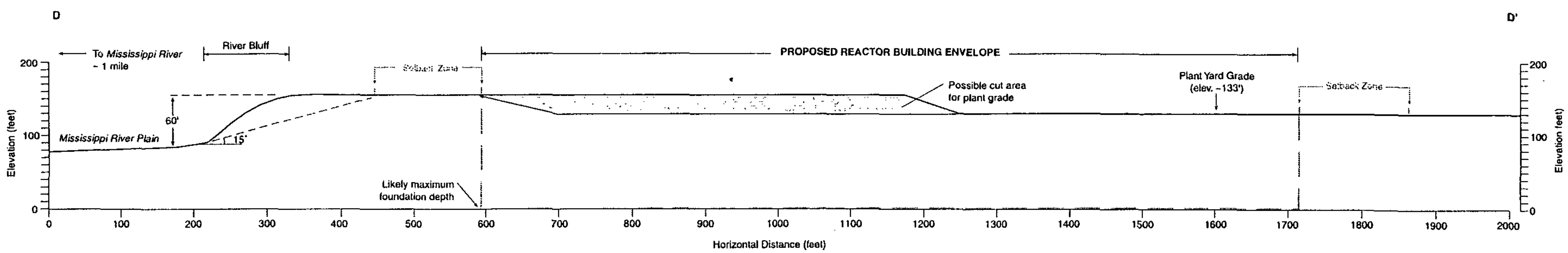
Geologic Units Correlation Table

<table>
<tr><th colspan="2">UFSAR Classification</th><th rowspan="2">Geologic Age</th><th colspan="2">ESP Classification</th><th>Notes</th></tr>
<tr><td>Hydrology Sections</td><td>Geology and
Geotechnical Sections</td><td>Geology and
Geotechnical Sections
(SSAR 2.5.1 - 2.5.6)</td><td>Hydrology Sections
(ER 2.3 and SSAR 2.4)</td><td rowspan="8">Artificial fill is defined as a separate unit for SSAR sections 2.5.1 - 2.5.6

Mississippi River alluvium is broken out into various subunits in ER section 2.3 and SSAR section 2.4

Terrace deposits referenced in UFSAR are generally correlative with Upland Complex undifferentiated used in the ESP SSAR

Weakly cemented sands in the upper part of the Cathoula Formation in the UFSAR are similar, and probably contemporaneous with, deposits in the ESP SSAR Upland Complex old alluvium</td></tr>
<tr><td></td><td></td><td>Modern</td><td>Artificial fill
(fill)</td><td></td></tr>
<tr><td>Mississippi River alluvium
Holocene alluvium
Floodplain alluvium
• Clay-silt alluvium
• Sand-gravel alluvium</td><td>Mississippi River alluvium</td><td>Holocene</td><td>Mississippi River alluvium
(young alluvium)</td><td>Mississippi River alluvium
Holocene alluvium
Floodplain alluvium
• Clay-silt alluvium
• Sand-gravel alluvium</td></tr>
<tr><td>Loess</td><td>Loess</td><td rowspan="3">Pleistocene</td><td>Loess</td><td>Loess</td></tr>
<tr><td rowspan="2">Upland terrace deposits
• Upland alluvium
• Pleistocene terrace deposits
• Terrace sand and gravel</td><td rowspan="2">Terrace deposits
(archaic)</td><td>Upland Complex alluvium
(alluvium)</td><td rowspan="3">Upland terrace deposits
• Upland alluvium
• Pleistocene terrace deposits
• Terrace sand and gravel</td></tr>
<tr><td rowspan="2">Upland Complex
old alluvium
(old alluvium)</td></tr>
<tr><td rowspan="2">Catahoula Formation</td><td rowspan="2">Catahoula Formation
(archaic as used)</td><td rowspan="2">Mio-Pliocene</td></tr>
<tr><td>Catahoula Formation</td><td>Catahoula Formation</td></tr>
</table>



GRAND GULF

Cross Section through Bluff

WLA William Lettis & Associates, Inc. | WLA Figure 2

Modified 11/22/06 1785 Entergy Grand Gulf/1785 Grand Gulf ASLB Hearings

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CERTIFICATE OF SERVICE

I hereby certify that copies of System Energy Resources Inc. Prefiled Testimony Concerning Hearing Issue [A Through I], with associated exhibits, in the above captioned proceeding have been served as shown below by deposit in the United States Mail, first class, this 22nd day of November, 2006. Additional service has also been made this same day by electronic mail as shown below.

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