November 22, 2006

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)	)	

NRC STAFF SUPPLEMENTAL PRE-FILED TESTIMONY
CONCERNING HYDROLOGY

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. Goutam Bagchi. I am a Senior Advisor in the Nuclear Regulatory Commission's (NRCs), Office of Nuclear Reactor Regulation (NRR), Division of Engineering (DE). A statement of my professional qualifications was attached to the NRC Staff's pre-filed testimony submitted on November 20, 2006, in response to hearing issues identified by the Board.

Q.2. Please describe your professional responsibilities with regard to the review of the application by System Energy Resources, Inc. ("SERI" or "Applicant") for an early site permit ("ESP") for a new nuclear power plant or plants to be located on the existing Grand Gulf Nuclear Station ("GGNS") site near Port Gibson, Mississippi.

A.2. As part of the NRC staff's health and safety review of the SERI ESP application, documented in NUREG-1840, the "Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site," April 2006 ("SER"), I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned hydrology.

Q.3. In the "NRC Staff's Proposed Findings of Fact and Conclusions of Law in the Mandatory Hearing," filed with the Board on August 11, 2006, the Staff indicated that it intended to clarify certain points in NUREG-1840 in pre-filed testimony. With respect to section 2.4.2.3 of NUREG-1840, please explain the difference between the effects of intense precipitation in the local site area and that in site region that leads to a probable maximum flood ("PMF").

A.3. In Section 2.4.2.3 of NUREG-1840, the Staff described how it used the National Oceanic and Atmospheric Administration ("NOAA") Hydrometeorological Report ("HMR") 52 guidelines to estimate the 1-hour 1-mi^2 probable maximum precipitation depth for the ESP site. However, the Staff did not explain the difference between the effects of intense precipitation in the local site area and those in the site region that lead to a probable maximum flood ("PMF").

Flooding can occur at a site through different mechanisms, two of which are the PMF and local intense precipitation. Local intense precipitation is a measure of the extreme amount of water falling in the immediate vicinity of the site no more than one square mile in area that is considered in the engineering design of local site drainage. In response to local intense precipitation, immediate flooding by ponding at the site may occur due to inadequate infiltration capacity and a lack of an efficient drainage system. The difference between the floods caused by local intense precipitation and PMF is that the former occurs at an immediate site, whereas PMF is the routed discharge from a probable maximum precipitation ("PMP") event occurring over an entire watershed within which a site is located.

PMF is derived by routing a PMP event through the watershed. NOAA Hydrometeorological Reports provide methods for estimation of PMP in watersheds of ten to 20,000 square miles for several durations (six to 72 hours). HMRs also provide methods for estimation of so-called "point" PMP of one-hour duration. NOAA recommends that a "point" be interpreted as a one square-mile area. HMRs provide maps to determine PMP values for

durations less than one hour for a point (one square-mile area); this PMP is the local intense precipitation (SER Tables 2.4-2 and 2.4-2a).

Q.4. Please clarify how mitigation measures for these two flooding mechanisms are different.

A.4. Protection from PMF may be provided by siting the plant above the PMF flood elevation, but flooding from local intense precipitation cannot be controlled by siting. Rather, flooding from local intense precipitation must be mitigated by an effective and efficient site drainage system.

Q.5. Please clarify what guidance the Staff used for estimating the design-basis flooding considering the worst single phenomenon, as well as combinations of less severe phenomena.

A.5. The Staff used RG 1.59, Rev. 2, “Design Basis Floods for Nuclear Power Plants,” August 1977, and ANSI/ANS-2.8-1992, “Determining Design Basis Flooding at Power Reactor Sites,” July 1992, for estimating the design-basis flooding considering the worst single phenomenon, as well as combinations of less severe phenomena. SER at 2-85. The Staff also used USGS, NOAA, Natural Resources Conservation Service (formerly the Soil Conservation Service), USACE, and applicable State and river basin authority publications to verify the Applicant’s data relating to extreme events in the region. SER at 2-85.

Q.6. Please clarify the Staff’s analysis of the Applicant’s PMP depth estimates and of flooding effects of local intense precipitation for the Grand Gulf ESP site .

A.6. With respect to the Applicant’s revised estimates of PMP depth, the Staff determined that these conformed to the latest HMR-52 criteria. SER at 2-88. The Staff also prepared its own estimates of PMP depths, and the Applicant’s estimates closely matched those of the Staff. SER at 2-88. Therefore, the Staff concluded that the Applicant’s PMP depth estimates were acceptable. SER at 2-88. Accordingly, the Staff established a site

characteristic for local intense precipitation, or PMP, of 19.2 inches per hour, of which 6.2 inches falls during the first 5 minutes. SER Table 2.4.14-1 at 2-141. This PMP is for a one square mile area, and is considered as local intense precipitation that would fall on the Grand Gulf ESP site rather than a PMF in the Mississippi River near the site caused by a PMP event in the Mississippi River Basin. The local intense precipitation will also be used to determine the flooding elevation in Streams A and B (located on the site, see SER at 2-74) and to design the site grading as described below.

The Staff noted that the area of Basin A (located on the site, see SER at 2-72) is 2.94 square miles, and that there is no guidance for determination of PMP values for areas that are larger than one square mile but smaller than ten square miles. Nonetheless, the PMP value for an area exceeding one square mile in size will be less than that for a one square-mile area (a point), and greater than that for a ten square-mile area. Therefore, one-square mile PMP (point PMP or local intense precipitation) is a conservative estimate (greater than the true value) for the PMP value for Basin A. Accordingly, flooding resulting from local intense precipitation based on a one-square mile PMP value for Basin A will also be conservative (more severe than the true value).

Based on the physical site topography and the location of the proposed powerblock area (PPBA) to the west of the site access road and downstream of existing culverts, the Staff found that it is reasonable to expect that flood water elevation in Streams A and B adjacent to the PPBA would be substantially less than that of the proposed ESP site grade. SER at 2-79. While a comprehensive flood water elevation analysis for the site cannot now be carried out, the Staff found further that, given the topographic location of the ESP site in relation to Streams A and B, an effective drainage system can be designed when a COL application is filed that references any ESP that might be issued. SER at 2-79, 2-80. Accordingly, the Staff established COL Action Item 2.4-3, which relates to the design of site grading. SER at 2-80.

The design of this grading will afford flood protection to safety-related structures for any new unit at the ESP site based on a comprehensive flood water routing analysis for a local PMP (local intense precipitation) event. SER at 2-80. Similarly, since the maximum water surface elevation depends on the site grade and locations of safety-related structures, as well as local intense precipitation, the Staff established COL Action Item 2.4-5, which relates to plant grade and drainage system design based on the maximum water surface elevation on the site. SER at 2-89. COL Action Item 2.4-5 provides that a COL or construction permit applicant should demonstrate that the ESP plant grade is safe from the flooding effects of maximum water surface elevation during local intense precipitation without relying on any active surface drainage systems that may be blocked during this event. SER at 2-89; SER Appendix A.2, Action Item No. 2.4-5.

Q.7. Please clarify the Staff's analysis with respect to the PMF from the Mississippi River.

A.7. In analyzing the PMF from the Mississippi River, the Staff determined a maximum wave height of 10.9 feet, and added this to the Mississippi River DPF to arrive at maximum water surface elevation. SER at 2-96. The Staff also agreed that the water surface elevation at peak PMF discharge will not be appreciably higher than 103 feet above MSL, the top surface elevation of the levee on the west bank of the Mississippi River. SER at 2-89. In this regard, the Staff established a site grade of 132.5 feet above MSL as a characteristic of the ESP site. SER at A-16. In view of the above, the Staff estimated that the highest water surface elevation in the Mississippi River as a result of the DPF, wind setup, and wave runup will not impact the ESP site since the maximum water surface elevation is significantly below the ESP site grade. SER at 2-87; SER § 2.4.3. Accordingly, a PMF on the Mississippi River will not cause flooding of the proposed Grand Gulf ESP site.

Based on the facts and reasoning documented in the SER, as well as those just mentioned, the Staff found that the Applicant provided sufficient information pertaining to floods.

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	)	
(Early Site Permit for Grand Gulf ESP Site)	)	

AFFIDAVIT OF GOUTAM BAGCHI CONCERNING
SUPPLEMENTAL PRE-FILED HYDROLOGY TESTIMONY

I, Goutam Bagchi, do hereby state as follows:

1. I am a Senior Advisor in the Nuclear Regulatory Commission's ("NRC's"), Office of Nuclear Reactor Regulation ("NRR"), Division of Engineering ("DE"). A statement of my professional qualifications was attached to the NRC Staff's pre-filed testimony submitted on November 20, 2006, in response to hearing issues identified by the Board.

2. As part of the NRC staff's health and safety review of the SERI ESP application, documented in NUREG-1840, the "Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site," April 2006 ("SER"), I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned hydrology.

3. I have primary technical responsibility for the NRC Staff Supplemental Pre-Filed Testimony Concerning Hydrology.

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Goutam Bagchi

Goutam Bagchi

November 22, 2006

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NRC STAFF SUPPLEMENTAL PRE-FILED TESTIMONY
CONCERNING GEOTECHNICAL ISSUES

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. Thomas M. Cheng. I am employed as a Senior Structural/Geotechnical Engineer in Geosciences and Civil Engineering Branch A (EGCA), Division of Engineering (DE), Office of Reactor Regulation (NRR), Nuclear Regulatory Commission (NRC). A statement of my professional qualifications was attached to the NRC Staff's pre-filed testimony submitted on November 20, 2006, in response to hearing issues identified by the Board.

Q.2. Please describe your professional responsibilities with regard to the review of the application by System Energy Resources, Inc. ("SERI" or "Applicant") for an early site permit ("ESP") for a new nuclear power plant or plants to be located on the existing Grand Gulf Nuclear Station ("GGNS") site near Port Gibson, Mississippi.

A.2. As part of the NRC Staff's health and safety review of the SERI ESP application, documented in NUREG-1840, the "Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site" ("SER"), I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned geotechnical engineering related issues.

Q.3. In the "NRC Staff's Proposed Findings of Fact and Conclusions of Law in the Mandatory Hearing," filed with the Board on August 11, 2006, the Staff indicated that it intended to clarify certain points in NUREG-1840 in pre-filed testimony. Please clarify the Staff's discussion in NUREG-1840 with respect to stability of subsurface materials and foundations.

A.3. With respect to stability of subsurface materials and foundations overall, the Staff concluded that the Applicant adequately determined the engineering properties of the soil encountered during its field and laboratory investigations, and that the Applicant provided sufficient technical information in the geotechnical area to demonstrate the suitability of the ESP site for building a new nuclear power plant. SER at 2-241. The Staff found that the Applicant used the latest field and laboratory methods, in accordance with RGs 1.132, 1.138, and 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," issued November 2003, to determine these properties. SER at 2-241. With respect to field investigations and laboratory testing necessary for the design of safety-related structures, however, the Staff also concluded that the Applicant did not perform activities sufficient to adequately define the overall subsurface profile, as well as the potential variability of the properties of the soil underlying the ESP site; the Staff therefore noted the Applicant's commitment to perform additional field investigations, once it has selected the locations and facilities for safety-related structures at the COL stage. SER at 2-241. In this regard, the COL action items included in SER Appendix A that relate to the stability of subsurface materials and foundations will prompt an applicant for a COL or CP to address the adequacy of the design of structures that would be built if a COL or CP were later granted.

Q.4. Please clarify the Staff's discussion in NUREG-1840 with respect to embankments and dams.

A.4. The Staff found that no impoundment structures lie within the ESP area. SER at 2-246. The Staff also found that the Applicant provided sufficient descriptions of the

embankments and dams in the site vicinity to support its ESP application. SER at 2-246. The Staff, in SER §§ 2.4.4 and 2.5.5, discussed all other issues relevant to dams and embankments, respectively. Since the Applicant did not evaluate the effect of potential flooding of the Mississippi River and possible future erosion of the bluff, as discussed in SER Section 2.5.5.1 (SER at 2-242), the Staff established COL Action Item 2.5-11, which provides that a COL or CP applicant should evaluate the effect of potential flooding of the Mississippi River and possible future erosion of the bluff, including their impacts on soil-structure interaction (SSI) effects of the plant. SER at 2-246, A-8. On this basis, the Staff concluded that the assessment of embankments and dams presented in this SSAR section is acceptable for the ESP application. SER at 2-246.

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AFFIDAVIT OF THOMAS M. CHENG CONCERNING
SUPPLEMENTAL PRE-FILED GEOTECHNICAL TESTIMONY

I, Thomas M. Cheng, do hereby state as follows:

1. I am employed as a Senior Structural/Geotechnical Engineer in the Geosciences and Civil Engineering Branch A (EGCA), Division of Engineering (DE), Office of Reactor Regulation (NRR), Nuclear Regulatory Commission (NRC). A statement of my professional qualifications was attached to the NRC Staff's pre-filed testimony submitted on November 20, 2006, in response to hearing issues identified by the Board.

2. As part of the NRC staff's health and safety review of the SERI ESP application, documented in NUREG-1840, the "Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site," April 2006 ("SER"), I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned geotechnical engineering related issues.

3. I have primary technical responsibility for the NRC Staff Supplemental Pre-Filed Testimony Concerning Geotechnical Issues.

4. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information, and belief.

Thomas M. Cheng

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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SYSTEM ENERGY RESOURCES, INC.	)	Docket No. 52-009-ESP
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(Early Site Permit for Grand Gulf ESP Site)	)	

NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney enters an appearance in the above-captioned matter. In accordance with 10 C.F.R. § 2.713(b), the following information is provided:

Name:	Tison A. Campbell
Address:	U.S. Nuclear Regulatory Commission Office of the General Counsel Washington, D.C. 20555
Telephone Number:	(301) 415-8579
Fax Number:	(301) 415-3725
E-mail Address:	tac2@nrc.gov
Admissions:	Commonwealth of Virginia
Name of Party:	NRC Staff

Respectfully submitted,

/RA/

Tison A. Campbell
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 22nd day of November, 2006

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NUCLEAR REGULATORY COMMISSION

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CERTIFICATE OF SERVICE

I hereby certify that copies of "NOTICE OF APPEARANCE" of Tison A. Campbell, "NRC STAFF SUPPLEMENTAL PRE-FILED TESTIMONY CONCERNING GEOTECHNICAL ISSUES," and NRC STAFF SUPPLEMENTAL PRE-FILED TESTIMONY CONCERNING HYDROLOGY," in the above-captioned proceeding, have been served on the following by deposit in the NRC's internal mail system as indicated by a single asterisk, or by deposit in the U.S. Mail, first class, as indicated by a double asterisk, this 22nd day of November, 2006:

Lawrence G. McDade, Chair
Atomic Safety and Licensing Board
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
(E-mail: LGM1@nrc.gov)

Dr. Nicholas G. Trikouros
Administrative Judge
Atomic Safety and Licensing Board
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
(E-mail: NGT@nrc.gov

Dr. Richard E. Wardwell
Administrative Judge
Atomic Safety and Licensing Board
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
(E-mail: REW@nrc.gov)

Office of Commission Appellate
Adjudication
Mail Stop 0-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555
(E-mail: OCAAMAIL@nrc.gov)

Office of the Secretary
ATTN: Docketing and Service
Mail Stop: 0-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555
(E-mail: HEARINGDOCKET@nrc.gov)

Kathryn Sutton, Esq.*
Paul M. Bessette, Esq.*
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Ave., N.W.
Washington, DC 20004
(E-mail: ksutton@morganlewis.com)
(E-mail: pbessette@morganlewis.com)

Debra A. Wolf
Law Clerk
Atomic Safety & Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
(E-mail: DAW1@nrc.gov)

/RA/

Tison A. Campbell
Counsel for the NRC Staff