September 29, 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 RESPONSE
TO LICENSING BOARD'S ORDER OF SEPTEMBER 13, 2006

On September 13, 2006, the Licensing Board in this proceeding issued an Order requiring the Staff to provide answers to ninety-five questions related to the Board's review of the Staff's Final Safety Evaluation Report (FSER) by 5:00 P.M. EST on September 29, 2006. In response to that Order the Staff is providing the following answers to the Board's questions. To the degree practicable, the Staff has integrated its answers into the electronic copy of Attachment A of the Board's Order immediately following the question propounded by the Board. However, where the length of the response made it impracticable to comply with this request, the Staff has provided separately attached responses for several answers, which are included in Attachment B. The reference figures discussed in the Staff's answer to Inquiry Number 17 are included in a separate document, which is labeled Attachment C.

Respectfully submitted,

Ann P. Hodgdon

Ann P. Hodgdon
Jonathan M. Rund
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 29th day of September, 2006

ATTACHMENT A

Grand Gulf ESP
SER Inquiries

Inquiry No.	SER Page	SER Section	Inquiry
1	General	General	The requirements of 10 C.F.R. § 52.17a(1)(i) indicate that the number of facilities should be specified. The ESP application documents do not provide a specific number of facilities to be built. Why did the Staff not require the Applicant to include a specific number? **Response:** As a general matter, the Staff cannot impose requirements beyond those in the regulations. The regulations at 10 CFR 52.17(a)(1)(i) state that the applications *should* include the specific number of facilities to be built but they do not *require* that the application contain this information.
2	General	General	In order to determine site acceptability, shouldn't the normal effluent evaluations (see, e.g., SER §§ 1-3) consider the combined effluents of all plants at the Grand Gulf site – i.e. existing and new facilities? If no, why not? **Response:** No. The ESP evaluation is based on the plant parameter envelope addressed by the Applicant. The regulations (10 CFR 52.17(a)(1)(iv)) state that an ESP application should describe the anticipated maximum levels of radiological effluents that each facility will produce. Thus, the Staff evaluated the impact from the proposed ESP facility. However, in NUREG-1817, Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site, the Staff did evaluate the impact of the combined radiological effluent discharges from the existing operating unit and proposed reactors. This is documented in Section 5.9, Radiological Impacts of Normal Operation.

Inquiry No.	SER Page	SER Section	Inquiry
3	General	General	For each of the computer code analyses performed in support of the application, please provide the following information: (A) Name of code (B) Revision Number (C) Purpose for which it was used in ESP application (D) Extent of the Staff's review of the code (E) Extent of the Staff's review of input/output (F) Any confirmatory analyses performed by the Staff (G) Review results and any review documentation produced by the Staff. **Response:** See Attachment B.
4	General	General	Please provide a copy of Appendix A to the draft SSAR, "Characteristics of Bluff Height". **Response:** In the SER we find the sentence: "The Staff notes that the site characteristic of bluff height previously included in Appendix A no longer plays a role in the Staff's evaluation, and has been deleted." The Appendix A to which the sentence refers is not in the Applicant's SSAR, but rather is in the version of the Final SER that the Staff provided to the ACRS. See Attachment B for a copy of the applicable page.
5	General	General	The DCDs for plants such as the AP1000 and the ESBWR include specific COL requirements. (A) Have these been reviewed and incorporated into the Grand Gulf SER where appropriate? (B) Have appropriate COL Action Items been developed to accommodate these plant-specific COL requirements? **Response:** (A and B). No. To incorporate any design certification COL Action items into the Grand Gulf ESP would be redundant. Once an applicant chooses a specific design, the applicant takes on the burden of addressing those COL Action Items in the SER for the design certification regardless of whether they are specifically mentioned in the ESP.

Inquiry No.	SER Page	SER Section	Inquiry
6	General	General	Many items were deferred from the ESP stage with a commitment to perform/address the issue at the COL stage. Please address the following: (A) With regards to draft SER open items: (1) Please discuss how the open items were tracked to assured that they were resolved. (2) Summarize any remaining open items, and highlight if these are now COL Action Items and if not, explain why not. (B) Some items deferred to the COL stage were listed as COL Action Items, others were simply noted as future commitments, while others were made into Permit Conditions. (1) Is there a comprehensive list of all commitments made by the Applicant and/or issues stated by the Staff in their review that were deferred from the ESP stage and are to be addressed during the COL stage (that are not already denoted as COL Action Items)? If not, please provide one. (2) What are the criteria for determining whether to list a commitment as a Permit Condition, a COL Action Item, or just a deferred COL item? (3) How are deferred commitments that are not listed as COL Action Items documented at this stage (so as to ensure fulfillment at the COL stage), and how will they be documented as complete during the COL stage? (C) The SER states (p. 1-8) that the "list of COL action items is not and should not be considered exhaustive." What are the implications of this for a COL application which references the ESP? Also, are all COL action items listed in Appendix A and if not, where are they recorded? **Response:** See Attachment B.

Inquiry No.	SER Page	SER Section	Inquiry
7	General	General	The SER states (see, e.g., p. 1-5, 2-41) that the Staff reviewed the Applicant's PPE values and found that they were not unreasonable. Please explain in more detail the extent and basis of your review. **Response:** Some of the values in the Applicant's PPE are based on reactor designs that are either certified, are in the certification process, or may be submitted for certification. In the case of those plants that have not been certified or even submitted for certification, the Staff can only use its judgment and experience to determine how reasonable a given value is. Because the Staff lacks pertinent information for some of the designs to be covered by the PPE, "not unreasonable" is a more realistic standard than "reasonable." Other values in the Applicant's PPE are parameters associated with the site. The Staff's intention in applying the standard of "not unreasonable" to these parameters is to eliminate from consideration the impractical. For example: a maximum tornado wind speed of 100 mph would be unreasonable; therefore, anything based on this parameter would not merit further consideration. The standard of "not unreasonable" is consistent with the guidance of RS-002.

Inquiry No.	SER Page	SER Section	Inquiry
8	SSAR Table 1.3-1	----------	The PPE (SSAR Table 1.3-1) identifies 4300 MWt as the maximum plant size, based on 3926 MWt with a 10% uprate. (A) How is this value utilized with respect to the number of plants to be built? What is the significance of this number? (B) The ESBWR is identified in its DCD as being 4500 MWt. What are the implications of this since the ESBWR is on the list of possible plants for this site? (C) The SSAR goes on to say that the reactor power goal is 2000 MWe. Does this value include the existing plant and is this reflected anywhere in the PPE? **Response:** (A) With respect to the SER, reactor thermal power is important only in how it affects values that are limiting such as offsite post-accident dose. (B) The ESBWR is currently characterized as being a 4500 MWt plant. If a future applicant wishes to reference the ESP for plants with a higher output than 4300 MWt, that applicant must justify the higher output at the CP or COL stage. (C) The value of 2000 MWe does not include the current operating plant. This number is not a bounding value and is not explicitly covered by the PPE. The value was chosen by the Applicant as an estimated target for power production from any new unit or units.

Inquiry No.	SER Page	SER Section	Inquiry
9	iii	Abstract	The SER indicates that a total of 8600 MWt is acceptable for the site with a max unit size of 4300 MWt. (A) What is the basis for the 8600 MWt since it is not supported in the application? (B) Does this mean that multiple units can be built as long as the maximum per unit is less than 4300 MWt and the site total is less than 8600 MWt, or is it controlled by the 2000 MWe power goal? **Response:** (A) This is based on two ABWR units. The ABWR at 4300 MWt was the largest unit initially considered by the Applicant. (B) Yes. The Applicant chose the value of 2000 MWe as an estimate of a future power production goal. The Applicant then looked at how the designs under consideration may be used in combination to meet this goal. The largest design considered at the time of the application was the 4300 MWt ABWR. In order to meet the 2000 MWe target, two ABWR units would be required. This would actually exceed the 2000 MWe target, but 2000 MWe is only an estimate and is not binding. There are other ways of employing the various designs under consideration to reach the estimated 2000 MWE target; for example, several modules of the PBMR design could be built. Of the combinations of designs under consideration, though, the Staff believes that the one that would result in the most thermal power being placed on the site is two ABWR units at 4300 MWt each.
10	xiv	Exec. Summary	The SER states that "This SER identifies applicable inspection reports as reference documents." However, these documents do not seem to be provided as references. Please explain this omission and provide the references for these inspection documents. **Response:** Because inspection reports are communications between the Staff and the Applicant, they are included in Appendix B to the SER, "Correspondence."

Inquiry No.	SER Page	SER Section	Inquiry
11	2-3	2.1.2	In regards to exclusion area authority and control, the SER states that SERI owns the surface rights, yet they have authorized Entergy to maintain control of ingress and egress. Explain further how this interaction will work: will there be any logistic problems between the two responsible parties during emergency operations? **Response:** The exclusion area is the area surrounding the reactor in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety will result. The authority to exercise control over all activities ultimately resides with the reactor license holder. In its safety review, the Staff identified authority and control of activities within the exclusion area as proposed ESP Permit Condition 1 (see SER Section 2.1.2.3 on page 2-6 and SER Appendix A). This proposed ESP permit condition would require that any applicant for a COL referencing this ESP, if granted, demonstrate that it has the authority to exercise control within the exclusion area, including the authority to maintain ingress to and egress from the exclusion area and to evacuate individuals from the exclusion area, in the event of an emergency. This proposed ESP permit condition would also require that any COL applicant referencing this ESP secure the arrangements to provide for control of ingress and egress and for the evacuation of individuals within the ESP exclusion area in the event of an emergency. This proposed ESP permit condition would require that such arrangements be obtained and executed before the granting of a COL referencing the ESP. The Staff plans to review the COL Applicant's response to this permit condition to ensure that it has the authority to exercise control of all activities in the exclusion area and to preclude any potential logistical problems.
12	2-3	2.1.3	The SER states that the Applicant did not identify any physical characteristics unique to the proposed ESP site that could pose a significant impediment to the development of emergency plans. Explain how the Staff verified the accuracy of and evaluated this representation. **Response:** See Attachment B.

Inquiry No.	SER Page	SER Section	Inquiry
13	2-4	2.1.2.1	The Applicant stated that arrangements would be made for the exercise of authority over the area within the exclusion area for the new facility on the site property but that such arrangements would be made in association with the COL application. (A) Explain the Staff's analysis of how this provides reasonable assurance that the Applicant will have the required control. (B) How is this commitment documented to insure that it will be addressed at the COL stage? **Response:** (A) As outlined in the Staff's response to Inquiry Number 11 above, the Staff identified authority and control of activities within the exclusion area as proposed ESP Permit Condition 1 (see SER Section 2.1.2.3 on page 2-6 and SER Appendix A). This proposed ESP permit condition would require that any applicant for a COL referencing this ESP, if granted, demonstrate that it has the authority to exercise control within the exclusion area, including the authority to maintain ingress to and egress from the exclusion area and to evacuate individuals from the exclusion area, in the event of an emergency. This proposed ESP permit condition would also require that any COL applicant referencing this ESP secure the arrangements to provide for control of ingress and egress and for the evacuation of individuals within the ESP exclusion area in the event of an emergency. This proposed ESP condition would require that such arrangements be obtained and executed before the granting of a COL referencing the ESP. The Staff plans to review the COL applicant's response to this permit condition to ensure that it has the authority to exercise control of all activities in the exclusion area. (B) The required commitment is documented as ESP Permit Condition 1 (SER Section 2.1.2.3 on page 2-6 and SER Appendix A) as described above to ensure that it will be addressed at the COL stage.
14	2-18	2.2.3.1	The Applicant stated that it will develop appropriate procedures to ensure safe shutdown in the event that raw water makeup is unavailable. Why is this not a Permit Condition or a COL Action Item? **Response:** This is not a siting issue; therefore, it should not be considered as a Permit Condition or a COL Action Item.

Inquiry No.	SER Page	SER Section	Inquiry
15	2-19	2.2.3.3	Please clarify how the additional analyses performed by the Applicant converted the peak pressure of 4 psi (which exceeded the acceptance criteria) to an acceptable value of 1 psi. **Response:** The estimate of 4 psi peak pressure was made by the Applicant in its initial analysis of the potential explosions associated with Mississippi barge traffic mishaps. The Applicant noted that this exceeded the 1 psi criterion of R.G. 1.91, but claimed that the presence of an intervening "65 foot bluff" between the river and the proposed site would attenuate the pressure to below 1 psi. In response to a request for a technical basis for the claimed pressure reduction, the Applicant elected to revise its evaluation of the hazard by providing a probabilistic screening analysis, which was used to demonstrate that the likelihood of a barge mishap in the vicinity of the proposed site leading to onsite pressures exceeding 1 psi was low, and that it met the screening criteria of SRP 2.2.3. Hence, the safety evaluation is not based on "converting" the value of 4 psi to 1 psi.
16	2-19	2.2.3.3	The SER states that "Section 2.2.1–2.2.2 of this SER describes potential hazards that might be identified in the future in association with a currently vacant industrial development in Claiborne County Port, just south-west of the ESP site." This potential hazards evaluation could not be found in the SER. Please indicate where it can be found or provide a copy of the evaluation. **Response:** There is not a separate formal potential hazards evaluation. In a discussion of nearby potentially hazardous industrial facilities in Section 2.2.1-2.2.2 of the SER, reference is made to "a small barge port at river mile 404.8, used for shipping forest and agricultural products." Since this facility is not a major shipping terminal, and since the commodities are mostly non-hazardous, it was the Staff's judgment that the facility did not present a significant hazard requiring formal analysis. The above clarification is not explicitly reflected in the SER.
17	General	2.3.1.3; 2.3.2	If the Staff were to evaluate all of the meteorological data, hurricane frequencies, etc. (see, e.g., SER pp. 2-33, 2-41), in terms of periodic increments, would it show a trend with the more recent years being more severe? Would this be indicative of climate change effects? **Response:** See Attachments B and C.

Inquiry No.	SER Page	SER Section	Inquiry
18	2-37	2.3.1.3	The Staff includes in its proposed regional climatology site characteristics (see Table 2.3.1-7) a recommendation to combine the 100-year snowpack with the 48-hour PMWP for roof loads. How will this recommendation be incorporated into the ESP license? **Response:** Both the 100-year snowpack and the 48-hour probable maximum winter precipitation (PMWP) will be listed as separate winter precipitation site characteristics in the ESP license as shown in Section A.3 of Appendix A (Site Characteristics). Both Grand Gulf ESP SER section 2.3.1.3 and SRP section 2.3.1 discuss how winter precipitation loads should be based on the weight of the 100-year snowpack at ground level plus the weight of the 48-hour PMWP at ground level for the month corresponding to the selected snowpack. Both documents also state that a COL or CP applicant may choose and justify an alternative method for defining the extreme winter precipitation load by demonstrating that the 48-hour PMWP could neither fall nor remain on the top of the snowpack and/or building roofs.
19	2-54	2.3.4.1	What PPE parameters were used in the PAVAN model in order to estimate X/Q at the EAB and LPZ? **Response:** None of the PPE values presented in the application were used in the PAVAN model to estimate χ/Q values at the EAB and LPZ. The most conservative assumptions possible regarding PPE values were used in executing PAVAN; e.g., the height and minimum cross-section area of the containment structure, which are used in the building-wake term, were set equal to zero and the release height was assumed to be at ground level.

Inquiry No.	SER Page	SER Section	Inquiry
20	General	2.4.1	The maximum makeup water flow rate is identified in SER § 2.4.1 (p. 2-68) and in Appendix A-4 (p. A-18) as 78,000 gpm. SSAR Table 1.3-1 also identifies 78,000 gpm as the max makeup flow rate. This is inconsistent with COL Action Item 2.4-4 (p. A-5), which indicates a maximum makeup water flow rate of 85,000 gpm. (A) Please provide an explanation. (B) Does the 78,000 gpm meet the needs of the 2000 MWe power goal? **Response:** (A) The Applicant stated in the SSAR, page 2.4-2, that the maximum makeup water requirement for the new ESP facility will be approximately 85,000 gpm: 78,000 gpm maximum blowdown from SSAR Table 1.3-1, and about 7,000 gpm of additional facility miscellaneous makeup requirements. The Staff used this combined flow rate in COL Action Item 2.4-4. (B) The makeup flow rate of 78,000 gpm reported in SSAR Table 1.3-1 is a PPE "Composite Value," which provides an envelope or bounding value of design parameters from the various plant designs considered by the Applicant for the ESP site. The 85,000 gpm specified in COL Action Item 2.4-4 will ensure that the design of the plant cooling system has sufficient margin to accommodate additional makeup requirements.

Inquiry No.	SER Page	SER Section	Inquiry
21	2-67	2.4.1.1	The SER states that "[a]dditional assessment to define the location and extent of perched aquifers would be conducted at the COL stage." (A) How are these additional studies going to be reflected in the ESP? (B) Why is this not a COL Action Item? (C) How will this commitment be documented to insure that it will be dealt with at the COL stage? **Response:** (A) The Staff precluded accidental release of any radioactive effluents from the radwaste facility of the proposed ESP plant as stated in Permit Condition 2. Thus, the additional studies referred to need not be reflected in the ESP. Further, the reactor type and other design details are not available at this time. These details will be available at the COL stage when the Applicant is required to submit a complete reactor design to be constructed at the ESP site. Therefore, a more detailed and effective review can be carried out using existing NRC regulations and regulatory guidance at the COL stage. (B) Location and extent of perched aquifers would affect the design of any facility constructed on the ESP site. NRC regulations exist to review these design aspects at the COL stage. The COL review will address the suitability of design of the facility and, therefore, no COL Action Item is needed in the ESP. (C) As explained in (A), the final design of the facility will be reviewed at the COL stage according to existing NRC regulations, regulatory guidance, and the Standard Review Plan.

Inquiry No.	SER Page	SER Section	Inquiry
22	2-76	2.4.1.3	The SER states that a detailed ground water monitoring program will be developed at the COL stage. (A) Why is this not a COL Action Item? (B) Is there a reason why Permit Condition 2.4-1 (relating to preclusion of accidental release from waste treatment storage facilities) is not included in Appendix A.1 of the SER? **Response:** (A) The Applicant committed to a detailed ground water monitoring program at the COL stage (SSAR Section 2.4.12.3, page 2.4-35). Details of the depth of embedment and the extent of the foundations of structures will only be available at the COL stage. NRC regulations and regulatory guidance contemplate detailed evaluation of these design details during the COL review. The COL review will ensure that appropriate ground water monitoring will be established for the specific reactor design chosen for the ESP site. (B) Permit Condition 2.4-1, referred to on SER page 2-76, is the same as Permit Condition 2, stated on SER page 2-140. Permit conditions from individual sections are integrated into a final and sequentially numbered list in Appendix A1 of the SER. Permit Condition 2.4.1 is Permit Condition 2 in Appendix A1.
23	2-115	2.4.8.3	Given that the SER does not include the UHS design data referenced in this section, please explain how the maximum makeup flow rate identified in COL Action Item 2.4-4 (p. 2-80) was determined? **Response:** The Applicant stated in the SSAR, page 2.4-2, that the maximum makeup water requirement for the new ESP facility will be approximately 85,000 gpm: 78,000 gpm maximum blowdown from SSAR Table 1.3-1, and about 7,000 gpm of additional facility miscellaneous makeup. The Staff used this combined flow rate in COL Action Item 2.4-4. This combined flow rate is the envelope or the bounding value for maximum makeup flow needed for all plant designs considered for the ESP site.

Inquiry No.	SER Page	SER Section	Inquiry
24	2-115 to 2-116	2.4.8.3	The SER's use of the word "frequently" with respect to the ESP facility's use of the UHS is not very precise (e.g., "The COL applicant must demonstrate that the UHS is not used frequently for non-emergency use."). (A) What does "frequently" mean with respect to the use of the UHS for non-emergency purposes? (B) Shouldn't this be specified more precisely as part of the UHS design basis? **Response:** (A) Within the context of UHS performance, the Staff considers that for normal plant operations there must be no reliance on the UHS. There is no specific number provided in the Staff guidance for frequency of UHS use for normal cooling. (B) Frequent reliance on the UHS indicates the inability of the normal heat sink (NHS) to support plant operations under all conditions except emergencies. An NHS designed with this goal would not rely frequently on the UHS for non-emergency use. Therefore, this is a design issue related to the NHS, and NRC regulations and regulatory guidance exist for review of this design, which will be available only at the COL stage.
25	2-124	2.4.11.2	The SER states that the design basis should identify and take into account the most adverse possible effects of these controls to ensure that essential water supplies are not likely to be negatively affected in the future. Why is this not a COL Action Item? **Response:** COL Action Item 2.4-6 addresses this concern by having a COL applicant demonstrate that sufficient water will be available for a 30-day UHS supply accounting for any losses from the dedicated water storage basin. SER at 2-126; Appendix A.2 at A-6.

Inquiry No.	SER Page	SER Section	Inquiry
26	2-127	2.4.12.1	What information did the Applicant use to select the reported hydraulic conductivities of the alluvium, terrace deposits, and Catahoula Formation? **Response:** For the operating unit at Grand Gulf, the UFSAR (2.4-42~44) states that K values for the alluvium formation are determined based on a constant-rate aquifer test, K values for the terrace deposit layer are based on both constant- and falling-head permeability tests, and K values for the Catahoula formation are based on laboratory consolidation tests on samples. For the ESP review, the Staff did not re-examine the exact nature and the range of hydraulic conductivities mentioned by the Applicant. The Staff considers these values to be a qualitative description of the conductivities of regional aquifers and not the basis for local conductivities, which should be estimated through field tests at the site. COL Action Item 2.4-9 states that a COL or CP applicant should provide detailed groundwater information including the depth of perched aquifers. This information, combined with the detailed design, will be adequate to assess the specific design at the COL stage.

Inquiry No.	SER Page	SER Section	Inquiry
27	2-127	2.4.12.1	The SER reports the Applicant's estimate that a maximum of 3570 gpm of groundwater would be needed during routine operations. What explorations and testing were performed to define the aquifer water limits and verify its yield to assure that the site could provide this flow without affecting either aquifer quality, the existing plant's needs, or the structural integrity of the buildings? **Response:** Excavation, construction, and fill of the subgrade portion of the ESP facility will considerably disrupt the near-field subsurface hydrology. Before a more detailed plant design is available including specific information of the changes in the subsurface environment directly caused by the construction and any active or passive dewatering systems, the Staff concluded that a detailed evaluation of the existing subsurface environment is not useful. COL Action Items 2.4-8 and 2.4-9 state that a COL or CP applicant should provide detailed groundwater information including the depth of perched aquifers. This information, combined with the detailed design, will be adequate to assess the specific design at the COL stage. In the FEIS, the issue of the potential impact of groundwater withdrawals on water quality within the Catahoula aquifer is unresolved. Prior to issuance of a COL, the COL applicant will need to demonstrate that groundwater withdrawals will not result in degradation of the water quality in the Catahoula aquifer. For the operating unit at Grand Gulf, the Applicant performed aquifer tests on two wells, #3 and #5, at the average pumping rates of 8000 gpm and 7600 gpm, respectively, which exceed the maximum planned withdrawal rate. Based on an analytical drawdown approach, the Applicant concluded that the groundwater levels in the site area are slightly modified as a result of the effects of radial collector well field pumpage, construction dewatering, topographic modifications, relocation of surface drainage systems, and structure installation (GG UFSAR, 2.4-44-46). Based on the above, the Staff expects that the impact of construction and operation of the ESP facility would have a minimal impact on the existing plant. Impact of construction on the existing plant is covered under the provisions of Part 50.

Inquiry No.	SER Page	SER Section	Inquiry
28	2-131	2.4.12.3	It appears that little, if any, aquifer testing has been done to determine the transmissivity of the geologic strata (e.g., K, T of loess, terrace alluvium) at the site. Is there a reason why these fundamental site characteristics have not been determined to date, considering their direct application to the ESP stage? **Response:** Excavation, construction, and fill of the subgrade portion of the ESP facility will considerably disrupt the near-field subsurface hydrology. Before a more detailed plant design is available including specific information of the changes in the subsurface environment directly caused by the construction and any active or passive dewatering systems, the Staff concluded that a detailed evaluation of the existing subsurface environment is not useful. COL Action Item 2.4-9 states that a COL or CP applicant should provide detailed groundwater information including the depth of perched aquifers. This information, combined with the detailed design, will be adequate to assess the specific design at the COL stage.
29	2-131	2.4.12.3	What is the degree of saturation in the loess and what is the potential for perched zones to exist that might provide this necessary condition for liquefaction? **Response:** Additional groundwater information is not known at the ESP stage. The Staff concluded that the site subsurface characterization was presently inadequate as a basis for the review of a specific detailed plant design. COL Action Item 2.4-9 states that a COL or CP applicant should provide detailed groundwater information including the depth of perched aquifers. Soil liquefaction potential is evaluated as a part of geotechnical review in in SER section 2.5.4. Blow counts from standard penetration tests, foundation placement at material with shear wave velocity greater than 1000 feet per second, and Permit Condition 3 are all aimed at ensuring that liquifiable materials are removed from the foundation base.

Inquiry No.	SER Page	SER Section	Inquiry
30	2-132 to 2-140	2.4.13	How will potential impacts from the new plant be separated from any existing impacts or future releases from the existing plant? **Response:** For impacts to members of the public and the environment from normal gaseous and liquid effluents, multi-unit plants typically have separate radioactive waste storage tanks and systems, components, and discharge points in order to control, monitor and document the type and amount of radioactive effluents discharged into the environment from each reactor unit. The standard NRC Technical Specifications for normal radiological gaseous and liquid effluents have controls that are on a unit specific basis. Thus, the Staff expects that at the COL stage an applicant will provide a sufficient level of detail to allow the Staff to evaluate the radiological impact of normal operation of a new unit as distinct from that of any existing operating unit.
31	2-135	2.4.13.3	What is the difference between retention and retardation and how do the modeling coefficients for these parameters differ? **Response:** "Retention" refers to the adsorption process, which results in "retardation" of the migration of a contaminant in porous media. The retention coefficient is also called the adsorption coefficient or K_d. The retardation coefficient, R, is the reduced rate of migration of the contaminant through the ground relative to the rate of migration in water. The retardation coefficient is related to the K_d via the following relationship: $R = 1 + B\frac{K_d}{w}$, where B is the bulk density of the subsurface material and w is the volumetric water content.
32	2-137	2.4.13.3	What is the difference between absorption and retention and how do the modeling coefficients for these parameters differ? **Response:** See response to Inquiry No. 31.

Inquiry No.	SER Page	SER Section	Inquiry
33	2-138	2.4.13.3	It is stated that the K_d values for Cs-137 and Sr-90 used in the ESP application "were established for site-specific calculations in the GGNS Unit 1 UFSAR." How were these coefficients established? **Response:** The Staff does not know how they were established but does not believe that it is necessary to know. The specific K_d values do not require review because Permit Condition 2 requires the plant design to preclude any and all future accidental releases into any potential liquid pathway.
34	2-138	2.4.13.3	The second table on page 2-138 shows values for terrace formation. It is not clear why there would be values for a geologic feature rather than for the material of which it is comprised (e.g. alluvium). (A) What material comprises these features and how does it differ from the two layers of alluvium for the Upland Complex? (B) Why is it not covered by either the clay-silt alluvium or the alluvium aquifer? **Response:** (A and B). Permit Condition 2 requires the plant design to preclude any and all future accidental releases into any potential liquid pathway. Therefore, the Staff did not conduct any evaluation of the specific hydraulic properties relevant to estimating the transport of accidental radwaste releases.
35	General	2.4.14	Is there any reason that SRP § 2.4.14, "Technical Specifications & Emergency Operation Requirements," was not addressed in the SER? And, why was the name changed to "Site Characteristics Related to Hydrology"? **Response:** At the ESP stage, details of the reactor design are not known. Issues related to Technical Specifications and Emergency Operation Requirements will be addressed at the COL stage. The Staff used continuous section numbering to report site characteristics related to hydrology in the last Hydrology section of the SER, Section 2.4.14.

Inquiry No.	SER Page	SER Section	Inquiry
36	General	2.5.1	There appear to be some inconsistencies when discussing the geologic strata at the site: (A) Some sections mention that the plant will be founded on the Catahoula Formation and other sections mention the Upland Complex. Which is it? (B) There are various representations of geologic strata beneath the site (e.g. description on page 2-161, 2-196-97; SSAR Figures 2.4-37, 2.5-76). Please discuss: (1) The discrepancies between these representations and describe further the relationship between terrace deposits and the Upland Complex. (2) The difference between the "Old Alluvium" and "New Alluvium" and verify that they both are part of the Upland Complex. **Response:** See Attachment B.
37	2-176	2.5.2.1.3	The shallow profile for ground motion consists of "75 feet of loess" on top of "85 feet of young Alluvium" on top of "40 feet of old Alluvium," on top of "25 feet of Catahoula Formation". Verify that the "young" and old Alluvium layers are of the Upland Complex? **Response:** The shallow profile described here is a base soil profile model used in calculating soil response to seismic waves. Variability in the base case shear wave velocity model is accommodated through development of 60 randomized profiles for each control motion. Young Alluvium and Old Alluvium are of the Upland Complex.
38	2-186 to 2-187	2.5.2.3.2	The final sentence on page 2-187 states that "this open item is resolved," presumably referring to RAI 2.5-9. Briefly explain what "open item" this is referring to. **Response:** This is referring to Open Item 2.5-3 in the Draft SER.

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39	2-190	2.5.3.1.1	What specific data (including spacing of exploration borings) were used in the previous investigations for the existing site to illustrate that the buried stratigraphic layers across the site were not deformed by faulting, folding, or tilting? **Response:** Previous investigations for the existing nuclear power plant used borehole data, satellite images, and regional geology to support the conclusion that buried stratigraphic layers across the site were not deformed by faulting, folding, or tilting. Beyond these, the mapping for the immediate nearby existing nuclear power plant foundation excavation – which, unlike a single borehole, extensively exposed the subsurface geology – revealed no evidence of the above mentioned deformations.
40	2-190	2.5.3.1.1	What, if any, analyses were performed to help assure that the spacing of geologic information was sufficiently small enough to allow the Applicant to differentiate between eroded surface and a deformed surface? **Response:** The Applicant gathered data to study the tectonic deformation from three different sources: 1) existing nuclear power plant investigations, 2) published and unpublished geologic mapping by USGS, the States of Mississippi and Louisiana, and the University of Memphis, and 3) seismicity data complied from published journals and evaluated as part of this study. The Applicant also conducted its own field reconnaissance, aerial photo interpretations, and updated geologic maps for the site location. The existing nuclear power plant is next to the ESP site, and the foundation construction excavation, which extensively exposed subsurface geology, provided sufficient information to allow the Applicant to differentiate between an eroded surface and a deformed surface.
41	2-192	2.5.3.1.1	What was the spacing of the borings along the Mississippi River that allowed USACE to conclude that the Quaternary deposits are not faulted? **Response:** The Staff does not know the spacing of the borings. This is a summary obtained by the Applicant after it reviewed the US Army Corps of Engineering report, "Geomorphology and Quaternary Geological History of the Lower Mississippi Valley," dated 1994. The Staff believed that the report, which covers an

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			extensive region, did not play a critical role in determining that Quaternary deposits were not deformed at the site. The Applicant used various sources and methods to study the subsurface strata and concluded that Quaternary deposits are not deformed at the site.
42	General	2.5.4.1	Statements are made (see, e.g., pp. 2-204, 2-227, 2-228, 2-240; SSAR at 2.5-80, 2.5-83) that geologic deposits (i.e. Catahoula Formation, Upland Complex of old Alluvium and new Alluvium, and loess) appear to be over- consolidated. This is the basis for assuming that the Ko for each strata should approach (and possibly exceed) 1.0. Likewise, on page 2-227, the SER notes that the Applicant concluded that the susceptibility of soil deposits to liquefaction is low (citing SSAR § 2.5.4.4). (A) What is the basis for saying that these strata are overconsolidated (e.g., field &/or laboratory tests)? (B) What is the resulting overconsolidation ratio? (C) What are the geologic mechanisms that might have caused this overconsolidation in the loess and Upland Complex/Old Alluvium and what is the evidence of this continuing to occur at the site? (D) How were the relative densities of loess calculated from the dry densities? (E) Were any moisture-density or max/min density tests performed to determine maximum density and relative potential for liquefaction? (F) What affect would a different interpretation (i.e. normally consolidated) have on the dynamic loading responses and liquefaction potential? (G) How does age of loess affect the resistance to liquefaction given its low density as reflected by the SPT? (H) If only the curve fitting to the EPRI modulus reduction and damping characteristics are used to support this supposition, elaborate more on this analysis (e.g., background for development of the EPRI curves; similarities of modeled soil to site geology for the application of predicting OCR; historical use of these curves to predict overconsolidation; sensitivity of the results to variations in interpretation; sample disturbance; etc.). **Response:** (A) The judgment on overconsolidation is based on an evaluation of CPT data as well as a review of consolidation test data obtained from previous investigations conducted by GGNS

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			for the existing facility's UFSAR. (B) The data provided in Entergy Grand Gulf ESP Technical report ENTO002-ER-02 (ER-02), "Geologic, Geotechnical, Geophysical Field Exploration and Laboratory Testing, Grand Gulf Nuclear Station, Early Site Permit," indicates overconsolidation ratios of about 1.5 to 5 for alluvium and greater than 2 for the loess. (C) In this region of the US, a number of processes could be responsible for the overconsolidated state, which typically would involve erosion of soils previously deposited. The topographic description for the site indicates that the area was at one time built up to an elevation of about 150 ft and was incised by channels to elevations as low as 100 ft. In addition, the area was used as a staging and laydown area for construction of the existing plant. (D) Relative densities were estimated from the laboratory dry density measurements, together with standard correlations of density with SPT blow counts. (E) The laboratory data summarized in the various reports indicate that no laboratory measurements of maximum/minimum densities were made. (F) Since the plant foundation is to be located below the loess formation, the change in assumption of overconsolidation ratio would have negligible impact on the estimates of site response. (G) The potential liquefaction of site soils depends not only on soil capacity but on seismic demand as well. Measured shear wave velocities through the loess vary from about 600 fps to over 1400 fps. Only the shallow profile may be susceptible to liquefaction. The plant foundation is to be located on the very stiff Catahoula formation, which is judged not to be susceptible to liquefaction due to its depth in the site profile as well as its high strength. It is the general experience, based on empirical and laboratory generic data, that older formations have more liquefaction capacity as compared to newer Holocene aged materials. The seismic demand (computed in terms of cyclic stress ratio) from design seismic motions with PGA computed to be less than 0.2g is judged to be small. Therefore, liquefaction is judged not to be a concern for standard plant designs. During the COL stage, additional borings taken

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			through the loess will be used to evaluate this potential for ancillary facilities associated with the plant that may be sited on the loess. (H) It should be noted that the experimentally determined modulus degradation and damping data were fit to the EPRI shapes and shown to be consistent with the recommendations provided in the EPRI 1993 study. That program used measured laboratory data from carefully conducted TSRC tests on granular soils varying in size from silty sands to fine gravelly sands. These shapes were then used in calibration studies to indicate that the 1D convolution approach to site response using the EPRI degradation models led to conservative estimates of surface site response as compared to empirically recorded motions. These comparisons were made against hundreds of recorded motions over a large range of soil site conditions. It should be noted that these shapes are not used to predict overconsolidation ratios, but only in site response calculations.
43	2-195	2.5.4.1.1	In regards to the stratification: (A) How was Su of the loess derived from SPT as reported in the SSAR page 2.5-77? (B) What is the relationship between the new term "Upland Alluvium" to the Upland Complex? **Response:** (A) As described above, the SPT blow counts were to estimate relative density. As indicated on page 25 of ER-02, undrained strength estimates were based on interpretations of the CPT data. (B) The description provided in the SSAR for the Upland Complex is the same as provided in ER-02 for the Upland Complex Alluvium.

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44	2-196	2.5.4.1.1	The SER notes that the Applicant will take additional borings in the fill area as part of the COL. Likewise, SSAR § 2.5.4.1 states that additional site exploration, laboratory testing, and geotechnical analyses will be performed for the COL. (A) Where will this commitment be reflected in the ESP license? (B) What QA/QC procedures have been developed to assure that the Staff will verify that this will be accomplished during the COL stage? **Response:** (A) It will be in the table of COL Action Items. (B) This commitment will be identified in the permit as a COL Action Item; therefore, any CP or COL application referencing this ESP should address it.
45	2-196	2.5.4.1.1	The SER references Figure 2.5.4-18 (SSAR Figure 2.5.4-60). The figure cannot be located (it is not listed in the list of Figures). Please indicate where in the submitted documentation it can be found, or provide a hard copy. **Response:** "SSAR Figure 2.5.4-60" should read "SSAR Figure 2.5-60." This figure can be located in Section 2.5 of the SSAR (ML032960402).
46	2-196	2.5.4.1.1	The SER states: "In its response, the applicant stated that Figure 2.5.4-18 (SSAR Figure 2.5.4-60) shows the BE profile which is based on a visual average of the three compression and shear (P-S) suspension log surveys obtained from the ESP site borings." What does the phrase "visual average of the three" surveys mean? **Response:** As shown in SSAR Figure 2.5-60, the foundation soil shear wave velocities taken from three boring data (B-3, B-2A and B-1) were plotted against the soil depth. Based on engineering practice experience and judgment, a straight line average (a step function of soil foundation depth) was determined by visual examination.

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47	2-196	2.5.4.1.1	What geotechnical information is available to define the properties of the in-situ fill, and is there certainty that differential settlement associated with the transition from native geology to fill will not cause unacceptable differential settlements? **Response:** No information on fill requirements has been identified. However, the standard controls used for specifying acceptable in-situ fill characteristics include laboratory compaction studies, acceptable grain-size characteristics, and measurements of in-situ compaction and minimum low strain shear wave velocities. If these procedures are followed, differential settlement of well-constructed structures will not be of concern.
48	2-200	2.5.4.1.1	The SER states that the "applicant will further verify the site stratigraphy by additional borings taken during the COL phase." Where do you propose to document this commitment? **Response:** COL Action Item 2.5-3 states that if the investigations (based on the information obtained from additional borings) to be performed during the COL stage indicate differences in material properties that may significantly impact on design ground motions, the COL applicant should evaluate the need to perform additional site response analyses with the updated properties to develop updated design ground motions.

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49	2-202	2.5.4.1.1	SSAR § 2.5.4.1.6 (pp. 2.5-80 to -81), lists average moisture content for loess as 22.8%, and for the Upland Alluvium as 19.2%. The fourth paragraph on page 2-202, however, lists these averages as 22% for loess and 68% for Upland Alluvium. (A) Please explain this discrepancy. (B) Given the average moisture contents of 22.8% and 19.2%, what is the approximate percentage saturation for these zones? **Response:** (A) The averages stated on SER page 2-202 are incorrect. In addition to the statement in SSAR Sections 2.5.4.1.6.1 (Page 2.5-80) and 2.5.4.1.6.2 (Page 2.5-81), the Staff also checked ER-02. Sections 10.1 and 10.2 of the report state that the average water content for Loess is 22.9% and the average water content for Upland Alluvium is 19.2%, respectively. (B) Using typical values for specific gravity, the degree of saturation is estimated to be approximately 70%.
50	2-227	2.5.4.1.3	Of what relevance does the discussion on the potential for karstic features have on the site response of soil to dynamic loading? **Response:** The potential for development of sinkholes, dissolution cavities or soft zones in calcareous clays and limestones below any site needs to be evaluated. If such soft zones or voids exist in the soil/rock profile below the site, the potential for collapse of these zones during and following a seismic event can lead to differential settlements at the ground surface. The impact of such collapse of void spaces below any plant needs to be evaluated.

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51	2-229	2.5.4.1.5	According to the SER, SSAR § 2.5.4.5 states that the new facilities will be founded on the Upland Alluvium, but also states that they will be founded upon soils that will have a V_s of 1000 fps or greater. (A) How will the verification of this parameter be achieved for design and construction? (B) How does Table 2.5.4-1 (SER p. 2-241) – "Minimum shear wave velocity of soil at plant foundation level" of 1000 fps – become incorporated into the ESP license documents: will it be a Permit Condition, COL Action Item, etc.? **Response:** (A) Since the requirement of minimum shear wave velocity of soil at plant foundation level is identified as a site characteristic (minimum design value of the soil shear wave velocity), this parameter can be verified by geophysical measurements taken before and during the design and construction of the plant. (B) As indicated in SER Table 2.5.4-1, a minimum shear wave velocity of soil at plant foundation level of 1000 ft/sec has been identified as a "site characteristic" and will be included in the Permit as such. There is no need to identify it as a "permit condition" or "COL action item."

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52	2-230	2.5.4.1.5	In regards to foundation design, how will the following SSAR commitments be reflected in the ESP license and addressed at the COL stage: (A) Investigate Vp zone at foundation depth (SSAR p. 2.5-78). (B) Evaluate uplift and dynamic loadings (SSAR p. 2.5-86). **Response:** (A) These are addressed by COL Action item 2.5-4. The P- and S-wave velocity profiles will be further investigated by additional borings, geophysical measurements, and samples that will be taken during the COL stage. These are necessary to provide verification regarding the soil properties of the zone with rise and fall of P-wave velocity, indicated in the SSAR. (B) If the site investigations meet the minimum site parameters (low-strain velocities and strengths) defined for the standard plant designs, there is no need for evaluation of uplift and dynamic loading, as the standard plant evaluations have already investigated this issue. If the site parameters do not satisfy the minimum site parameters, the COL applicant should perform SSI evaluations for the plant to determine uplift evaluations needed for the plant design evaluations.

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53	2-233	2.5.4.3.1	COL Action Item 2.5-3 is a commitment to perform additional borings, laboratory testing, and a geophysical survey to define site stratigraphy. (A) Explain your rationale in evaluating whether there is sufficient information to evaluate potential fatal flaws for the ESP license. (B) Are all the different needs for additional subsurface information (e.g., aquifer boundaries, perched zones, hydraulic parameters, geotechnical engineering parameters, stratification delineation, observations of potential faulting in the Pleistocene deposits, defining the limits and properties of the fill, etc.) sufficiently stipulated in this COL Action Item to assure that they will be made at the COL stage? (C) Are three borings a reasonable representation of standard practice for indicating site variability to assure no fatal flaws in the acceptability of the ESP, specifically the impracticability of delineating, removing or bypassing all material with <1000 fps shear velocity? (D) What is meant by a geophysical survey or is "geophysical surveys" a better term? **Response:** See Attachment B.
54	2-240	2.5.4.3.7	The SER states that the Applicant "does not expect to encounter any Holocene materials or relatively loose sands or silts that may be susceptible to liquefaction at the ESP site location." However, there were only three borings made in the ESP site and in each of those there were many low blow-counts obtained in the loess. As an aeolian material, wouldn't this strata be susceptible to liquefaction at the anticipated low densities actually reported for this material? **Response:** The characteristics of the loess materials are relatively well known from the long period of their evaluation in this area. Due to their depositional environment, the material is typically known to be uniform over large areas. However, it is clear that the conclusions based on only three borings need to be verified by a detailed site-specific investigation program that will be required during the COL stage.

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55	2-241	2.5.4.3.10	Why isn't the Applicant's commitment to require a minimum V_s of 1000 fps at the foundation grade a COL Action Item? **Response:** The Staff considers a minimum V_s of 1000 ft/sec at the foundation grade to be a "Site Characteristic" (minimum design shear wave velocity at the site), which will be verified during the COL stage. It is included in the Site Characteristics Table (Table A.3) of Appendix A to the Staff's SER and will be included in the Permit.
56	2-242	2.5.5.1	Statements of site stability seem to be contradicted by the observed slough in the loess. (A) Why are the slope movements on the bluff called a postulated slump instead of just a slump? (B) To support ths ESP, what field studies have been made to investigate the stability of the bluff and creep characteristics of the loess? (C) Why isn't the existing scarp (i.e. slough) indicative of recent movements and potential bluff instabilities? (D) The SER states that the plant will likely be setback 100' from the bluff, but the SSAR (p. 2.5-84) notes a 150' setback. How does the safety factor for stability change for the variation in these distances, and what is considered an adequate safety factor? (E) Would the static safety factor be influenced by blast induced pressure waves and aggravated by potential liquefaction? **Response:** See Attachment B.

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57	2-243	2.5.5.3	(A) How is the Applicant's restricting the location of the PPBA to 110' from the west side bluff area incorporated into the ESP license documents? (B) Why wasn't a distance of 150' used in accordance with the SSAR? (C) Why wasn't this requirement turned into a COL Action Item? **Response:** (A) As indicated in Applicant's response to RAI 2.5.5-1 dated December 10, 2004, the ESP site plan was modified to restrict the location of the plant foundation to a distance of over 100 ft from the bluff area. (B) In Section 2.5.5 (Page 2.5-87) of the ESP SSAR, Revision 3, the Applicant stated that the future plant footprint will be sited at least 100 ft from the bluff. This SSAR commitment is consistent with the SER. (C) Since both the site plan and the SSAR provide that the plant foundation would be sited at least 100 ft from the bluff, this issue was not identified as a COL action item.
58	2-243	2.5.5.3	Why isn't quantitative stability and deformation analyses of bluff – incorporating retrogressive failures with erosion – part of the ESP analyses? **Response:** The Applicant did not perform quantitative stability and deformation analyses. Based on simplified checks of slope stability by the Staff, the potential impact of the slopes – on overall stability of a plant located at least 100' from the bluff on the stiff material at depths of the planned foundation level – is small.

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59	2-246	2.5.6	Why isn't COL Action Item 2.5-11 – flooding of the Mississippi River and erosion of the bluff – an open item to be addressed at the ESP application stage? **Response:** Since the selection of the facility has not been finalized by the Applicant, detailed evaluations of impact of bluff erosion and stability on plant design cannot be made. This issue is properly considered a COL Action Item, not an open item.
60	General	11	(A) How do the algorithms from GASPAR relate to those used in RESRAD? (B) What was the rationale for selection of GASPAR to model gaseous effluent exposures? **Response:** (A) There is no relationship between GASPAR and RESRAD for the evaluation of normal gaseous effluents from a nuclear power reactor. RESRAD is a computer model designed to estimate radiation doses and risks from residual radioactive materials. It is primarily used for evaluating the radiological impact from radionuclides in soil. (B) GASPAR was used because it is the NRC standard code for evaluating the dose impact from normal radioactive gaseous effluents. The NRC issued a technical reference and users guide in March 1987, NUREG/CR-4653, "GASPAR II - Technical Reference and User Guide." The code uses the equations and parameters contained in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I."

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61	General	11	The SER does not appear to include an independent Staff evaluation of this section. There is only a summary of what is contained in SSAR § 3.2 and ER §§ 3.5 & 5.4. Please identify the nature of the Staff's review of this section. **Response:** The Staff's contractor did perform independent calculations of dose to members of the public from normal gaseous and liquid radiological effluents, using the Applicant's source term data, meteorological data, and liquid dispersion data. The computer codes GASPAR II and LADTAP II were used for the calculations. This independent calculation work is cited in Section 5.9, "Radiological Impacts of Normal Operation," contained in the Environmental Impact Statement (NUREG-1817, "Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site"). The calculation work performed for the EIS was used for the evaluation of the impacts of normal radioactive effluent discharges in other parts of the application.

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62	11-2	11.3.1	The SER states that the Applicant will control and monitor the release of gaseous effluents from the facility. How? Also provide the Staff's analysis of how this will insure compliance with 10 CFR Part 20. The Applicant provided bounding gaseous effluent release data. How did the Staff verify the accuracy and adequacy of this data? **Response:** At the ESP stage, the Applicant is not required to provide specific details on plant systems and components that will be used to control and monitor normal radioactive discharges. The PPE concept only requires that the radioactive source term and resultant calculated doses to members of the public be included in the ESP application. As a practical matter, historical data on radioactive effluents released from nuclear power plants shows that there is excellent compliance with the radiological ALARA dose objectives in Appendix I to 10 CFR Part 20. Thus, the Staff does not believe that it will be a problem for an applicant to adequately control and monitor the release of radioactive effluents. This issue will be evaluated at the COL stage. The Applicant provided a bounding source term based on the range of reactor designs being considered. The Staff's contractor performed independent dose calculations using the Applicant's data. The results showed compliance with the 10 CFR Part 20 annual dose limits for members of the public.
63	11-2	11.3.1	The SER states that the calculated gaseous pathway total body dose is 0.844 mrem/yr. However, SSAR Table 3.2-5 indicates 1.62 mrem/yr. Is there a reason for this discrepancy? **Response:** The 0.844 mrem/yr value in the SER is the dose to an maximally exposed individual at the site boundary for only the inhalation pathway. This is only part of the total dose of 1.62 mrem/yr to a maximally exposed individual, made up of the summary of doses from the plume pathway and consumption of food products pathway. The Staff only used that individual pathway instead of the total of all pathways. The dose value of 1.62 mrem/yr reported in the EIS is correct.

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64	11-2	11.3.1	Is there a table that compares the composite normal release provided in the ER (e.g., Table 3.0-8) to the criteria limits in Table 2 of 10 C.F.R. Part 20, Appendix B? **Response:** No. The Staff did not perform a comparison of the concentrations in Appendix B to 10 CFR Part 20 against the values provided by the Applicant. The appropriate acceptance criteria is dose to members of the public, not concentration.
65	11-3	11.3.2	What was the rationale for selection of LADTAP II to model liquid effluent exposures? **Response:** LADTAP II was used because it is the NRC standard code for evaluating the dose impact from normal radioactive liquid effluents. The NRC issued a technical reference and users guide on April 1986, NUREG/CR-4013, "LADTAP II - Technical Reference and User Guide." The code uses the equations and parameters in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I."
66	11-3	11.3.2	Where in the SSAR is it evident that the Applicant calculated a liquid pathway dose of 2.17 mrem/yr? **Response:** The Applicant did not include the calculated dose from a liquid pathway in the SSAR. The liquid pathway was evaluated in the Applicant's Environmental Report. The 2.17 mrem/yr calculated dose is in the Environmental Report and was independently calculated, using the Applicant's input data, by the Staff's contractor, with similar results.

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67	General	13	Most of section 13 is incomplete and contains requirements to be addressed at the COL stage. Why shouldn't the critical issues of emergency planning and evacuation be resolved at the ESP stage? **Response:** In its ESP application, the Applicant requested approval of "major features" of the emergency plans per 10 CFR 52.17(b)(2)(i), and not approval of complete and integrated plans per 10 CFR 52.17(b)(2)(ii). In general, the scope of the major features application and review focused on a "description" of various aspects of proposed emergency plans against the selected and modified emergency planning standards and evaluation criteria as cited in Section III of Supplement 2 to NUREG-0654/FEMA-REP-1, rather than final plan implementation. The Staff will review complete and integrated emergency plans submitted in a COL or OL application, in consultation with the Department of Homeland Security (DHS), to determine whether they comply fully with the requirements of 10 CFR 50.47, "Emergency Plans," and Appendix E to 10 CFR Part 50, "Emergency Planning and Preparedness for Production and Utilization Facilities," based on the evaluation criteria cited in NUREG-0654/FEMA-REP-1.

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68	General	13	The ESP application incorporates the current state and local emergency plans. During the limited appearance session held in Port Gibson on August 28, 2006, certain local officials indicated that their emergency plans required updating. Will the Staff be requiring the Applicant to update the emergency plans, or work with the communities surrounding the Grand Gulf site to update the plans, as part of the COL process? Particularly, will the Staff require the Applicant to incorporate lessons learned from Hurricane Katrina? **Response:** As indicated in the response to Inquiry No. 67 above, the scope of the major features application and review focused on a "description" of various aspects of proposed emergency plans against the selected and modified emergency planning standards and evaluation criteria as cited in Section III of Supplement 2 to NUREG-0654/FEMA-REP-1, rather than final plan implementation. The Staff will review complete and integrated emergency plans submitted in a COL or OL application, in consultation with the Department of Homeland Security (DHS), to determine whether they comply fully with the requirements of 10 CFR 50.47 and Appendix E to 10 CFR Part 50. These complete and integrated emergency plans, when submitted, will need to be up-to-date. The emergency preparedness information provided by the Applicant and the Staff's review guidance were both developed prior to Hurricane Katrina, which occurred in August 2005, and the Staff's review of the application was substantially completed prior to August 2005. As such, the lessons learned from Hurricane Katrina were not considered in the development of the SER. However, the Staff has contracted with Sandia National Laboratory to conduct a study to assess emergency response planning and implementation in the aftermath of Hurricanes Katrina and Rita. The results of the study will be considered in future rulemaking actions or the revision of applicable regulatory guidance.

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69	13-4; 13-56 to 13-92	13.3.1.1; 13.3.3.11	The SER states that "In Section 2.2.1 of Part 4, the applicant further noted that a detailed evaluation of the original 1986 ETE undertaken in May 2003 more fully considered the impact of historical population growth and transportation system improvements." This was an evaluation of the 1986 ETE, but was not identified as replacement of the 1986 ETE to bring the entire study up to date. (A) Why was this not a full update of the 1986 ETE, and why is it acceptable to the Staff in light of the lessons learned from Hurricane Katrina? (B) The 1986 ETE is not consistent with NUREG/CR-4831, which was published after the 1986 ETE was performed. The 2003 ETE seems to be incomplete. For example, it made no attempt to update (or review) the modeling used in the 1986 ETE study. The large number of RAIs associated with section 13.3.3.11 is indicative of the need to fully update the 1986 ETE study. (C) Does the Staff consider this evaluation to be adequate for a COL application? If not, why is there not a COL Action Item to formally update the 1986 ETE in its entirety? **Response:** See Attachment B.

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70	13-8	13.3.1.1	The SER states that in RAI 13.3-73, the Staff asked the Applicant to discuss other factors in addition to evacuation, such as the availability of adequate shelter facilities. In its response the Applicant "noted that, given the existence of fully approved, exercised, implemented, and periodically updated State and local plans, a presumption exists concerning the current adequacy of these plans and their effectiveness in providing required protective actions, including evacuation and shelter." (emphasis added). How did the Staff verify the acceptability of this presumption? **Response:** The RAI was based on a template developed to ensure a standardized review among ESP applicants, and it reflects a statement made in Section II.2 of Attachment 2 to Review Standard (RS) 002, "Processing Applications for Early Site Permits." This RAI when issued did not appropriately consider the use of existing State and local emergency plans in support of GGNS, Unit 1, which, as stated in Applicant's response, are periodically exercised under the requirements in Section IV.F.2 of Appendix E to 10 CFR Part 50. Therefore, the existing State and local plans are presumed to be adequate based on DHS's review as it relates to the approval of major features of these plans. The Staff will review complete and integrated emergency plans submitted in a COL or OL application, in consultation with the Department of Homeland Security (DHS), to determine whether they comply fully with the requirements of 10 CFR 50.47 and Appendix E to 10 CFR Part 50 based on the evaluation criteria cited in NUREG-0654/FEMA-REP-1.

Inquiry No.	SER Page	SER Section	Inquiry
71	13-25 to 13-26	13.3.3.3.1	The SER indicates that the Applicant "expects" that arrangements will be made for ambulance and medical services for the new facility, similar to the current facility. What is the basis for this expectation? Also, how would injured or contaminated individuals be transported to the Ochsner Clinic which is a significant distance from the proposed facility. **Response:** Section 3.12 (Medical and Public Health Support) to Part 4 identifies Claiborne County Hospital, located approximately six miles from the plant site, as the primary medical facility, and a letter of agreement with Claiborne County Hospital is contained in Appendix A to Part 4. Section 3.12 to Part 4 also identifies River Region Medical Center and The Ochsner Clinic as backup medical facilities, consistent with existing GGNS Unit 1 Emergency Plan. 10 CFR 52.17(b)(3) requires the Applicant to describe contacts and arrangements with Federal, State, and local agencies with emergency planning responsibilities. Since the River Region Medical Center and The Ochsner Clinic are private sector organizations, specific letters of agreement with these hospitals are not required at the ESP stage for a major features plan. In regard to the transport of an injured person to any designated offsite medical facility, including The Ochsner Clinic, Section 3.12 to Part 4 indicates that transportation would be provided by regional ambulance service, equipped with radios to maintain communications with the medical facility and capable of providing support on a 24-hour per day, seven days per week basis. Arrangements also exist as part of routine hospital emergency protocols for the rapid transport of critically injured patients between regional hospitals and major medical facilities, such as The Ochsner Clinic. Since the regional ambulance service is a private sector organization, a specific letter of agreement with this private organization is not required at the ESP stage for a major features plan. In addition, a description of arrangements for transporting victims of radiological accidents to medical support facilities is not required at the ESP stage for a major features plans per the evaluation criteria contained in Major Feature L (Medical and Public Health Support) in Supplement 2 to NUREG-0654/FEMA-REP-1.

Inquiry No.	SER Page	SER Section	Inquiry
			Response (continued): The Staff will review letters of agreement with private sector organizations providing backup medical support and regional ambulance services upon its review of complete and integrated emergency plans submitted in a COL or OL application to determine compliance with 10 CFR 50.47 and Appendix E to 10 CFR Part 50.
72	13-27	13.3.3.3.3	The SER states that the Staff agrees with the Applicant – in its response to RAI 13.3-16 and 13.3-17 – that "LOAs with private sector organizations are outside the scope of the 10 CFR 52.17(b)(3) requirement and will be provided at the COL stage." (A) Why is this not a COL Action Item? (B) Has the Staff evaluated the capability of these facilities to provide the expanded support needed for the additional ESP facility? Did the Staff evaluate the adequacy of the proposed training described in section 3.15 of the Applicant's ESP application? **Response:** See Attachment B.

Inquiry No.	SER Page	SER Section	Inquiry
73	13-32	13.3.3.4.3	Nuclear facilities in the vicinity of the Grand Gulf facility were not identified by the Applicant in the SSAR, nor identified by the Staff in the SER. Emergency coordination between the ESP facility and GGNS-1 is also not discussed. Why didn't the Staff require the Applicant to identify other nuclear facilities that can be relied on to provide assistance in an emergency? **Response:** The evaluation criterion under Major Feature C (Emergency Response Support and Resources) to Supplement 2 of NUREG-0654/FEMA-REP-1 does not require major features plans to identify all nuclear facilities or organizations in the vicinity of the existing GGNS Unit 1 facility, but rather only those identified and, as such, relied upon to provide assistance in an emergency. The nuclear and other facilities and organizations identified in the Applicant's major features plan are consistent with those described in the existing GGNS Unit 1 Emergency Plans and existing State and local emergency plans for an emergency at GGNS Unit 1. At the ESP stage for a major features plan, the Applicant is only required to describe emergency response support and resources based on the evaluation criteria provided in Supplement 2 to NUREG-0654/FEMA-REP-1. The specific coordination of resources between the proposed facility and GGNS Unit 1 does not need to be defined at the time of an ESP application. The Staff will review plan implementation, including the coordination of resources and support, as part of the complete and integrated emergency plans submitted in a COL or OL application, to determine this capability based on the evaluation criteria provided in NUREG-0654/FEMA-REP-1.

Inquiry No.	SER Page	SER Section	Inquiry
74	General	13.3.3.6	NUREG-0654, Appendix 1, indicates that notification should be made to the NRC within 15 minutes for an unusual event and sooner for other classes. The time is measured from the recognition by the operator of the events associated with a particular declaration. Shouldn't this be reflected in the emergency plan? **Response:** Appendix 1 to NUREG-0654/FEMA-REP-1, "Basis for Emergency Action Levels for Nuclear Power Facilities," does not specifically state that notification of the NRC is necessary but only that prompt notification of offsite authorities is intended within about 15 minutes for the unusual event class and sooner (consistent with other emergency actions for other actions) for other classes. This notification of "offsite authorities" reflects the requirements of Section D.3 of Appendix E to 10 CFR Part 50, which states: "A licensee shall have the capability to notify responsible State and local governmental agencies within 15 minutes after declaring an emergency" (underline added). The notification of the NRC subsequent to the declaration of an emergency class is governed by the requirements of 10 CFR 50.72(a)(3), which states that "The licensee shall notify the NRC immediately after notification of the appropriate State or local agencies and not later than one hour after the time the licensee declares one of the Emergency Classes." Section 3.5.1 to Part 4 accurately reflects the notification of "offsite authorities" within 15 minutes, and the notification of the NRC per the requirements of 10 CFR 50.72(a)(3). Section 3.5.1 to Part 4 also accurately reflects the notification of these agencies following event classification, which is consistent with the requirements of Appendix E to 10 CFR Part 50 and 10 CFR 50.72(a)(3), rather than from the recognition by the operator of the events associated with a particular declaration. In addition, the guidance in NRC Emergency Preparedness Position (EPPOS) No. 2, "Timeliness of Classification of Emergency Conditions," establishes the Staff position that a 15-minute goal is a reasonable period of time for assessing and classifying an emergency once indications are available to control room operators that an emergency action level (EAL) has been exceeded.

Inquiry No.	SER Page	SER Section	Inquiry
75	13-45	13.3.3.7.3	Draft SER Open Item 13.3-1a is identified as resolved, but it has been re-categorized as an item to be incorporated into the COL stage. Shouldn't this be a COL Action Item? If no, why not? **Response:** No. Notwithstanding any Staff approval of a proposed major feature in this SER, all features of the emergency plans requiring a description pursuant to Appendix E to 10 CFR Part 50, but that are not described in the ESP application, will be reviewed in the context of a COL or OL application. The Staff will review complete and integrated emergency plans submitted in a COL or OL application to determine whether they comply with such requirements, as well as the requirements of 10 CFR 50.47. As such, the Staff does not believe that a COL action item is necessary.
76	13-52 to 13-53	13.3.3.9.3	Open Item 13.3-3 describes the need for additional information regarding OSC, TSC, & EOF. The Staff states that there is insufficient description of the emergency facilities and related equipment for the TSC, OSC, & EO and, therefore, concludes that proposed major feature H is unacceptable. How has this been resolved? **Response:** In its response to RAI 13.3-34, the Applicant stated that it had not made an evaluation or decision as to whether the existing Unit 1 OSC and EOF facilities could or would be shared, and that Part 52 design certification, which establishes the TSC design criteria, would need to be incorporated based on the plant design when selected. As such, in its submittal dated June 21, 2005, the Applicant stated that it considered the remaining open questions regarding the OSC, TSC, and EOF (Open Item 13.3-3) to be more appropriately addressed in the context of complete and integrated emergency plans, which would be submitted with a COL application, rather than in the ESP application. The capabilities of the Applicant's OSC, TSC and EOF will be reviewed by the Staff in accordance with NUREG-0696 as part of complete and integrated emergency plans submitted in a COL or OL application, to determine whether they comply with the guidance and meet the standards of 10 CFR 50.47 and the requirements of Appendix E to 10 CFR Part 50.

Inquiry No.	SER Page	SER Section	Inquiry
77	13-90	13.3.3.11.3	Discuss the Staff's analysis of the Applicant's response to RAI 13.3.79c, and explain why the Staff considers the Applicant's response to be acceptable. **Response:** The Applicant's use of the 2003 ETE Study to update and verify the evacuation times in the original 1986 ETE for GGNS Unit 1 was determined by the Staff to be appropriate (See response to Inquiry No. 69). Major Feature J (Protective Response) only requires the Applicant to describe the concept for implementing protective measures, including the proposed means of relocation, which is addressed in the existing State and local emergency plans. The Staff will review plan implementation, including proposed means of relocation, as part of the complete and integrated emergency plans submitted in a COL or OL application, to determine this capability based on the evaluation criteria provided in NUREG-0654/FEMA-REP-1.
78	13-90 to 13-91	13.3.3.11.3	Open items 13.3-1c, g, h, and i are noted in the SER as "resolved," however, they appear to be pending for the COL stage since "arrangements would need to be expanded to incorporate relevant aspects of a proposed new reactor design in a COL . . . application." As such, shouldn't these be replaced as COL Action Items? **Response:** No. Notwithstanding any Staff approval of a proposed major feature in this SER, all features of the emergency plans requiring a description pursuant to Appendix E to 10 CFR Part 50, but that are not described in the ESP application, will be reviewed in the context of a COL or OL application. The Staff will review complete and integrated emergency plans submitted in a COL or OL application to determine whether they comply with such requirements, as well as with the requirements of 10 CFR 50.47. As such, the Staff does not believe that a COL action item is necessary.

Inquiry No.	SER Page	SER Section	Inquiry
79	13-94	13.3.3.12.1	The Applicant noted that it will write specific emergency procedures for the issuance of permanent record dosimetry devices and self-reading dosimeters to emergency personnel. How will this commitment be documented so that compliance can be verified at the COL stage? **Response:** The evaluation criteria under Major Feature K (Radiological Exposure Control) of Supplement 2 to NUREG-0654/FEMA-REP-1 only require an organization to describe how it would acquire and distribute dosimeters. The intent is addressed in the use of specific procedures by the Applicant to provide for the issuance of dosimeters. The Staff will review the complete and integrated emergency plans submitted in a COL or OL application to determine this capability, based on the evaluation criteria provided in NUREG-0654/FEMA-REP-1. The actual submission of implementing procedures will be in accordance with the requirements of Appendix E to 10 CFR Part 50.
80	13-116	13.6.3	Explain the Staff's analysis of why restriction to river access is not required given the fact that the new facility will sit in close vicinity to the east side of the Mississippi River. **Response:** In its ESP application review, the NRC Staff (security) uses 10 CFR 100.21(f), which states that site characteristics must be such that adequate security plans and measures can be developed. During other phases of the new reactor application process, the NRC Staff (security) will assess the applicant's physical protection systems, which incorporates specific plant design, site features, and the applicant's proposed security operational programs (physical protection, training qualification, and contingency response). Access to waterways would be reviewed and assessed during this segment of the new reactor application process.

Inquiry No.	SER Page	SER Section	Inquiry
81	General	15.1; (SSAR § 3.3.1)	Section 15.1 lists the DBAs that were chosen for radiological analysis. The SSAR indicates that Regulatory Guide 1.183, NUREG-0800, and NUREG-1555 were used to pick these events. The events shown in SSAR § 3.3.1 include those in Regulatory Guide 1.183 plus small line breaks outside containment. Events such as feedwater line breaks, liquid & gaseous tank Failures, reactor coolant pump shaft break and spent fuel cask drops are not included. These are identified in NUREG-0800 and also identified in the AP1000 DCD. In addition, the AP1000 DCD (see DCD §§ 15.7.3, 15.7.6) requires the COL Applicant to evaluate a liquid rad waste tank failure. What was the Staff's rationale for excluding certain events from its review? **Response:** See Attachment B.

Inquiry No.	SER Page	SER Section	Inquiry
82	15-1 to 15-2	15.1; (SSAR § 3.3.1)	The DBA events listed in the SER are not fully consistent with the events listed by the Applicant in the SSAR. Additional events were included in the SSAR, specifically: reactor coolant pump shaft break and PWR feedwater system pipe break. Why were these events excluded from the Staff's review? **Response:** As outlined in the Staff's response to Inquiry 81 above, the Staff identified inconsistencies between the exact titling of DBAs between the ESP Applicant's SSAR and in the Staff's SER. The "Reactor Coolant Pump Shaft Break" identified in the SER and in NUREG-1555 is the same DBA as the "Reactor Coolant Pump Locked Rotor," listed in the ESP Applicant's SSAR. NUREG-0800 listed this event as "Reactor Coolant Pump Rotor Seizure and Reactor Coolant Pump Shaft Break," which postulated as an event an instantaneous seizure of the rotor or break of the shaft of a reactor coolant pump. Regarding the "PWR feedwater system pipe break," the Staff does not consider it necessary to analyze it as a separate DBA because it is bounded by the LOCA. This event is not listed in RG 1.183, NUREG-1555, the SSAR, or the SER as a DBA. Only NUREG-0800 lists this event, as Feedwater System Pipe Break Inside and Outside Containment (PWR)." The DBAs listed in the SER are fully consistent with the DBAs listed by the ESP Applicant in the SSAR. Neither the SER nor the SSAR listed PWR feedwater system pipe break as a DBA.

Inquiry No.	SER Page	SER Section	Inquiry
83	15-2	15.1	The SER cites Regulatory Guide 1.183. Section 4.1.5 of the Guide states that "[t]he maximum two-hour TEDE should be determined by calculating the postulated dose for a series of small time increments and performing a 'sliding' sum over the increments for successive two-hour periods. The maximum TEDE obtained is submitted. The time increments should appropriately reflect the progression of the accident to capture the peak dose interval between the start of the event and the end of radioactivity release." (emphasis added). What time increments were used by the Staff in determining the maximum 2-hour dose, and what was the basis for the choice? **Response:** The Applicant's dose assessments were directly extracted from design certification documentation previously submitted to and reviewed by the NRC in connection with the design certification applications. The ABWR analysis was based on the source term described in TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites,"and was a "first two-hour" analysis. The ABWR design certification predated NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," and RG 1.183. The AP1000 EAB dose analysis was based on the source term described in NUREG-1465 and was an "any two-hour" or "worst two-hour" or "maximum two-hour" analysis. In performing the analysis for the design certification, the Staff used its radiological consequence computer code, "RADTRAD: Simplified Model for RADionuclide Transport and Removal And Dose Estimation," described in NUREG/CR-6604. The RADTRAD code estimates transport and removal of radionuclides and radiological consequence doses at selected receptors every 0.3 hour and then interpolates the doses for 0.1 hour (6 minute) increments to determine the maximum 2 hour EAB dose over the DBA. From NUREG-1465, the LOCA DBA includes the "gap" and "early in-vessel" release phases and, for a PWR, the release of the fission products is assumed to terminate at 1.8 hours from the initiation of the postulated accident. In addition to the EAB analysis, the LOCA dose is tabulated for the entire duration of the postulated accident (assumed to be 30 days) at the low population zone distance.

Inquiry No.	SER Page	SER Section	Inquiry
84	15-2	15.1	Are the methodologies used by the Applicant to develop time dependent activity releases in response to RAI 3.3-2 consistent with the AST for the AP1000 and TID source term for the ABWR? **Response:** As outlined in the Staff's response to Inquiry 83 above, the Applicant's dose assessments were directly extracted from design certification documentation previously submitted to and reviewed by the NRC in connection with the design certification applications. Therefore, while the Applicant did not perform a new analysis, the methodologies used in conjunction with the design certifications were consistent with the AST for the AP1000 and TID source term for the ABWR.
85	15-2 to 15-3	15.1	In RAI 3.3-4 the Staff indicated that the AP1000 DCD updated its X/Q values and asked whether the Applicant planned to use updated values in revising its application. The Applicant responded that it chose not to use them for the ESP. In addition, in RAI 3.3-7, the Staff asked the Applicant to provide the X/Q ratios between the ESP and DCD values. (A) What are the obligations of a COL applicant with respect to X/Q values? (B) How would this vary for different plant designs? (C) Should this be a COL Action Item? If no, why not? **Response:** (A) A COL applicant that references any certified design should submit the postulated χ/Q values provided in the latest approved version of the DCD. (B) A COL applicant that references an ESP based on, for example, the AP1000, but plans to reference a different plant design, should not use the postulated χ/Qs of the AP1000. (C) No. This is not a COL Action Item because it only applies to a COL applicant that references the AP1000 certified design.

Inquiry No.	SER Page	SER Section	Inquiry
86	15-3	15.2	The applicable NRC guidance documents used by the Staff appear to be incomplete. Given that the ABWR offsite dose analyses performed by the Applicant did not utilize the AST approach, why did the Staff not utilize Regulatory Guides 1.4, 1.5, and 1.7? **Response:** RG 1.4, "Assumptions used for Evaluating the Potential Radiological Consequences of A Loss of Coolant Accident for Pressurized Water Reactors," is only applicable for pressurized water reactors. The ABWR is a boiling water reactor. Consequently, as outlined in the SER, RG 1.3, "Assumptions used for Evaluating the Potential Radiological Consequences of A Loss of Coolant Accident for Boiling Water Reactors," was used in performing the DBA analysis for the ABWR design certification. In addition, the Staff used RG 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors," and RG 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," for the analysis for the ABWR design certification.

Inquiry No.	SER Page	SER Section	Inquiry
87	15-3	15.2	Was an independent review conducted by the Staff for the ABWR non-AST evaluation, and the AP1000 AST evaluation? **Response:** As outlined in the Staff's response to Inquiry 83 above, the Applicant's dose assessments were directly extracted from design certification documentation previously submitted to and reviewed by the NRC in connection with the design certification applications. Therefore, while the Applicant did not perform a new analysis, the methodologies used in conjunction with the design certifications were consistent with the AST for the AP1000 and TID source term for the ABWR. The Staff's independent review occurred at the time of the design certification. As outlined in the SER (see Section 15.3.4 in page 15-8), because the ESP Applicant simply used the ratio of the site-specific χ/Q value to the postulated design χ/Q value along with the calculated doses in the certification document, the Staff did not consider an independent calculation to be useful or necessary. The details regarding the Staff's independent confirmatory evaluations were documented in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design,"and NUREG-1793, "Final Safety Evaluation Report Related to the Certification of the AP1000 Standard Design."

Inquiry No.	SER Page	SER Section	Inquiry
88	15-5	15.3.1	The SER states that "At the time of any [COL] application that might be filed with respect to . . . the Grand Gulf ESP site, the applicant will confirm, and the Staff will evaluate, whether the analyses considered here bound the design proposed in the COL or CP application." Why was this requirement not identified as a COL Action Item analogous to COL Action Item 11.1-1? **Response:** This is not a COL Action Item because this is a specific requirement for a COL applicant referencing an ESP. 10 CFR 52.79(a)(1) states that "In general, if the application references an early site permit, the application need not contain information or analyses submitted to the Commission in connection with the early site permit, but must contain, in addition to the information and analyses otherwise required, information sufficient to demonstrate that the design of the facility falls within the parameters specified in the early site permit . . ." Consequently, the Staff will evaluate the COL applicant's demonstration that the design is bounded by the previous (i.e., ESP) analysis.

Inquiry No.	SER Page	SER Section	Inquiry
89	15-8	15.4	What specific parameters of the PPE were used as inputs to the radiological consequence analyses? How realistic and reasonable are these PPE values? **Response:** The ESP Applicant's PPE values used as inputs to the radiological consequence evaluation are the postulated χ/Q values and the radionuclide-specific release rates to the environment (source term). The Staff review guidance was outlined in RS-002, "Processing Applications for Early Site Permits" (ML032340334). The Staff used the following guidance in Section 4.8 to inform its review. "A PPE is a set of values of plant design parameters that an ESP applicant expects will bound the design characteristics of a reactor or reactors that might be constructed at a given site, and it serves as a surrogate for actual reactor design information. . . . The Staff expects that margins applied to account for uncertainties in PPE values will be identified in each application. Each Staff reviewer should determine whether the PPE values are sufficient to support the review, and that the PPE values are not unreasonable for consideration in the Staff findings to comply with 10 CFR Part 52, Subpart A. . . . Given that PPE values do not reflect a specific design and will not be reviewed by the NRC Staff for correctness, the granting of an ESP by the NRC does not indicate NRC approval of the site for any specific plant or type of plant." The Staff found that the PPE values were sufficient to support the site suitability review, were consistent with design certification information, and were consistent with the experience from operating reactor licensing reviews. Consequently, the Staff did not find that the PPEs were unreasonable.

Inquiry No.	SER Page	SER Section	Inquiry
90	General	App. A	Why did the bluff height characteristics found in Appendix A of the draft SSAR, no longer play a role in the Staff's evaluation? **Response:** In the draft SER, the bluff was counted on to mitigate the pressure wave from a postulated barge explosion on the Mississippi River. However, the ACRS was not convinced by the Applicant's analysis of the postulated explosion, and the Applicant re-evaluated the postulated accident probabilistically. The probabilistic evaluation indicated that such an accident was of low enough probability not to be considered as a design basis accident under acceptance criteria of RS-002. Because the accident is no longer considered, the bluff's height need no longer be specified in the ESP. (See discussion in response to Inquiry No. 15).
91	A-2 to A-3	App. A.1	The SER states that it "is proposing that the Commission include eight permit conditions," but only 3 are listed. What were the other 5 permit conditions and how were they resolved? **Response:** This is an administrative error caused by using a template of standard wording that had previously been used for a site with eight permit conditions. The final SER for Grand Gulf was issued with only three permit conditions.

Inquiry No.	SER Page	SER Section	Inquiry
92	A-2	App. A.1	Permit Condition No. 2 requires that an Applicant referencing this ESP to "design any new unit's radwaste system with features to preclude any and all accidental releases of radionuclides into any potential liquid pathway." (A) What is the existing groundwater quality? (B) What monitoring is proposed to verify groundwater compliance? (C) If present, how will the existing impacts be separated from any potential new impacts from an additional plant? (D) Does this Permit Condition not say that any level of detected radionuclides would automatically be a license violation? (E) When would the monitoring plan and action plans to address detected levels be developed, and are there any reasons not to address these plans at the ESP stage? **Response:** (A) Assuming that the Board's question is in reference to radiological contaminants, the Staff concluded, in proposing Permit Condition 2, that the existing groundwater quality did not require further review. If there is no possibility of accidental release from the ESP facility, any contamination in the existing groundwater would not be caused by accidental releases from the ESP facility. The Applicant will need to demonstrate at the COL stage that the specific design would preclude any and all accidental releases. However, this proposed permit condition would not preclude normal releases, which are not considered in SER Section 2.4.13. (B) The Applicant provided information on its existing radiological environmental monitoring program (REMP). The REMP will be used for any new facility built. The REMP does not include any provision for monitoring on-site ground water. The REMP does include two drinking water sampling locations; one near the site and one approximately five miles away. This item will be evaluated at the COL stage. (C) This level of plant information is not required at the ESP stage. (D) Yes, the Permit Condition proposed for inclusion by the Staff would require the Applicant to design a radwaste system with features to preclude any and all accidental releases of radionuclides into any potential liquid pathway. (E) Development of monitoring plans for accidental releases requires a specific design. The properties of the subsurface environment will be disturbed during excavation and fill. The subgrade portion of the plant will represent a hydraulic barrier. Any monitoring system design would require detailed information not available at the ESP stage. The Staff expects that this information will be provided at the COL stage.

Inquiry No.	SER Page	SER Section	Inquiry
93	A-4	App. A.2	Why is the North Anna ESP referenced in the introduction paragraph? **Response:** This is an administrative error caused by using a template of standard wording which had previously been used for the North Anna site.
94	A-6	App. A.2	COL Action Item 2.4-9: Why hasn't the detailed characterization of the ground water been performed at the ESP stage? Isn't it needed to assure site suitability? **Response:** Please see Staff's responses to Inquiries 21, 22, 26, 28, and 29.
95	A-18	App. A.4	Appendix A.4 identifies a PPE value, or bounding parameter value, as "one that necessarily depends on a site characteristic." We cannot correlate the PPE parameters with the list of site characteristics in Appendix A.3. There are a number of other important site related PPEs that are not identified as bounding. What characteristics make a PPE parameter "bounding"? **Response:** A bounding parameter is one on which a site characteristic depends.

ATTACHMENT B

Grand Gulf ESP
SER Inquiries

BOARD INQUIRY #3. For each of the computer code analyses performed in support of the application, please provide the following information:

(A) Name of code

(B) Revision Number

(C) Purpose for which it was used in ESP application

(D) Extent of the Staff's review of the code

(E) Extent of the Staff's review of input/output

(F) Any confirmatory analyses performed by the Staff

(G) Review results and any review documentation produced by the Staff.

Response (radiological)

A: GASPAR II and LADTAP II codes contained in NRCDOSE.

B: Revision 2.3.5

C: Used to calculate dose to members of the public from normal radioactive gaseous and liquid effluents.

D: The codes have been used by the Staff since the late 1980s. The incorporation of the codes into NRCDOSE was done by a contractor. The contractor performed benchmarking of the code. The Staff did not perform any independent review of the code.

E: The Staff's contractor reviewed the Applicant's input data sets and output dose values for appropriateness. The values were declared appropriate. The Staff's contractor independently calculated the dose using the Applicant's input data and obtained similar results.

F: The Staff's contractor performed independent calculations of dose to members of the public from normal radiological effluents, using the Applicant's source term data, meteorological data, and liquid dispersion data.

G: The summary/results of the Staff's contractor are contained in the EIS. The report states that independent calculations of the Applicant's dose information were performed.

Response: (seismic and geoscience)

The Applicant and its technical experts used numerous codes in calculating seismic hazards at the ESP site. Most computer codes were used in providing data and information for the Section 2.5.2, "Vibratory Ground Motion" and Section 2.5.4, "Stability of Subsurface Materials and Foundations." Some computer codes were directly used in calculating seismic hazards and some were embedded in the Applicant's procedure: for example, the codes used by the Applicant's contractor, GeoVision, to calculate subsurface P and S wave velocity profiles in the suspension logging. Because the Applicant established a QA system for its investigations and results, the Staff believes that the code-checking should occur only when the Staff has concerns about the results or conclusions. The attached list summarizes the main codes used by the Applicant in the Grand Gulf ESP application (see Table next page).

Table of Seismic and Geosciences Computer Codes -3-

Name of Code	Revision Number	Purpose for which it was used in ESP application	Extent of the Staff's review of the code	Extent of the Staff's review of input and output	Any confirmtaory analyses performed by the Staff	Review results and any review documentation produced by the Staff
EQHAZARD seismic hazard computation package	Unknown	The package is used in computing seismic hazard at the site	This package had been reviewed previously and compared with another computation package from the Lawrence Livermore National Laboratory. Both methodologies, including data input and output were approved and endorsed by NRC	The input and output were also reviewed by the NRC Staff and approved and endorsed in Regulatory Guide 1.165	The results between LLNL and EPRI were compared and analyzed extensively	Review results were published in the NUREG/CR 4885
Magnitude Conversion	Unknown	The program is used in converting earthquake body wave magnitude into moment magnitude	There are three formula used in calculating the mean values for the conversion relationship	Not reviewed	No	No
Ground Motion Attenuation	Unknown	The program is used in estimating ground motion for rock condition at the site	No	Not reviewed	It was reviewed during the North Anna ESP application	The ground motion relationship used by the Applicant is reviewed by USGS ground motion experts.
Soil Profile Randomization	Unknown	The program is used in randomizing the soil profile to accommodate the variation of the soil properties	No	Not reviewed	No confirmatory analyses performed by the Staff	No
codes used in calculating shear wave velocity profiles	Unknown	The code was used in many site investigations	No	Not reviewed	No confirmatory analyses performed by the Staff	No

Response: (local climatology)

A: Name of code: SACTI (Seasonal and Annual Cooling Tower Impacts)

B: Revision Number: Unknown

C: Purpose for which it was used in ESP application: An assessment of potential cooling tower plume impact (e.g., visible plumes and fogging) from the addition of new cooling towers to support the new plant.

D: Extent of the Staff's review of the code: The code was developed for EPRI as a result of a collaboration between Argonne National Laboratory, the University of Illinois at Urbana/Champaign, and the University of Illinois at Chicago. The code is based on a number of research papers and reports identified in Section 5.3.3.1 (Heat Dissipation to the Atmospheric) of NUREG-1555 (Environmental Standard Review Plan) as appropriate references to models for evaluating the atmospheric effects of cooling system operation.

E: Extent of the Staff's review of input/output: The Staff did not review the code inputs but did review the code output as described in SSAR Section 2.3.2.2 for reasonableness.

F: Any confirmatory analyses performed by the Staff: The Staff did not perform any confirmatory analyses. The Applicant concluded that the new facility's cooling system would have no significant impact on meteorological conditions at ground level, and the Staff believes that this conclusion is not unreasonable.

G: Review results and any review documentation produced by the Staff: Refer to the response to item (F) above.

Response: (short-term diffusion estimates)

A: Name of code: PAVAN

B: Revision Number: 2.0

C: Purpose for which it was used in the ESP application: Calculate atmospheric dispersion factors (χ/Q values) at the EAB and LPZ for use in evaluating the consequences of design basis accidents.

D: Extent of the Staff's review of the code: The code was developed for the Staff by Pacific Northwest Laboratory and is documented in NUREG/CR-2858, "PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations." The program implements the guidance of Regulatory Guide 1.145.

E: Extent of the Staff's review of input/output: In RAI 2.3.4-2, the Staff asked the Applicant to provide a copy of the PAVAN computer code input and output files used to generate the EAB and LPZ χ/Q values presented in SSAR Section 2.3.4. The Applicant complied with this request and the Staff reviewed both the input and output of the code.

F: Any confirmatory analyses performed by the Staff: The Staff ran its own version of the code (Revision Number 3.0, which represents a conversion of Revision Number 2.0 to run on a PC under a Windows environment) and obtained similar results.

G: Review results and any review documentation produced by the Staff: The Staff independently evaluated the resulting atmospheric dispersion estimates by running the PAVAN computer model and obtaining similar results. A comparison of the Applicant's and Staff's results is as follows:

	χ/Q Value (s/m^3)				
	EAB	**LPZ**			
Source	**0-2 hrs**	**0-8 hrs**	**8-24 hrs**	**1-4 days**	**4-30 days**
Applicant	5.95×10^{-4}	8.83×10^{-5}	6.16×10^{-5}	2.82×10^{-5}	9.15×10^{-6}
Staff	5.75×10^{-4}	8.63×10^{-5}	6.06×10^{-5}	2.81×10^{-5}	9.30×10^{-6}

Response: (long-term diffusion estimates)

A: Name of code: XOQDOX

B: Revision Number: 2.0

C: Purpose for which it was used in the ESP application: Calculate atmospheric dispersion factors (χ/Q values) and deposition factors (D/Q values) at points of potential maximum concentration outside the site boundary, at points of maximum individual exposure, and at points within a radial grid of sixteen 22½ degree sectors extending to a distance of 50 miles. These χ/Q and D/Q values are used in evaluating the consequences of routine airborne releases.

D: Extent of the Staff's review of the code: The code was developed for the Staff by Pacific Northwest Laboratory and is documented in NUREG/CR-2919, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations." The program implements the guidance of Regulatory Guide 1.111.

E: Extent of the Staff's review of input/output: In RAI 2.3.5-1, the Staff asked the Applicant to provide a copy of the XOQDOQ computer code input and output files used to generate the χ/Q and D/Q values presented in SSAR Section 2.3.5. The Applicant complied with this request and the Staff reviewed both the input and output of the code.

F: Any confirmatory analyses performed by the Staff: The Staff ran its own version of the code (Revision Number 2.0) and obtained similar results.

G: Review results and any review documentation produced by the Staff: The Staff independently evaluated the resulting atmospheric dispersion estimates by running the PAVAN computer model and obtained similar results. A comparison of some of the Applicant's and Staff's results is as follows:

Type of Location	Source	χ/Q Value (s/m³)		D/Q Value (1/m²)
		No Decay Undepleted	No Decay Depleted	
Site Boundary	Applicant	8.8×10^{-6}	7.8×10^{-6}	1.2×10^{-8}
	Staff	9.2×10^{-6}	8.2×10^{-6}	1.2×10^{-8}
Nearest Home	Applicant	2.2×10^{-6}	1.9×10^{-6}	7.0×10^{-9}
	Staff	2.2×10^{-6}	2.0×10^{-6}	6.8×10^{-9}
Nearest Garden	Applicant	2.0×10^{-6}	1.7×10^{-6}	5.4×10^{-9}
	Staff	2.0×10^{-6}	1.7×10^{-6}	5.2×10^{-9}
Nearest Milk Cow	Applicant	7.0×10^{-8}	4.7×10^{-8}	8.7×10^{-11}
	Staff	7.0×10^{-8}	4.7×10^{-8}	8.4×10^{-11}
Nearest Meat Cow	Applicant	1.4×10^{-7}	1.1×10^{-7}	4.0×10^{-10}
	Staff	1.4×10^{-7}	1.1×10^{-7}	4.1×10^{-10}

Response: (site hazards)

(A) ALOHA

(B) Revision 5.4

(C) To estimate downwind concentrations of postulated releases of various gases/vapors.

(D) The Staff did not review the code.

The Staff did note that the code is used routinely by the U.S. Environmental Protection Agency. Also, the Staff issued RAIs regarding clarification of ALOHA modeling of mixtures of chemicals and hilly terrain.

The plume dispersion distances to specific concentrations estimated by the Applicant were judged to be reasonable on the basis of Staff's past reviews of plume dispersion characteristics. The Staff also took into account conservatisms used in the analyses, such as 1) overestimation of plume size due to neglecting river current effects on depletion of spill formation on surface water, 2) underestimation of atmospheric dispersion by neglecting mechanical turbulence caused by ground roughness, 3) overestimation of spill pool area by assuming spill location to be the river's edge closest to the ESP site, as well as by neglecting the river width as a constraint in the development of a spill pool surface area, and 4) selection of meteorological conditions, the collective and cumulative occurrence of which is normally unlikely.

(E) The Staff did not review the input/output of the code.

(F) The Staff did not perform a confirmatory analysis of the ALOHA results.

(G) Applicant's responses to Staff RAIs (Entergy letter to the NRC, CNRO-2006-00011, dated February 22, 2006).

Page from Appendix A referenced in Response to Inquiry No. 4

Site Characteristic	Value	Definition
2.1 - Introduction		
Exclusion Area Boundary	The perimeter of a 2760 ft radius circle from the circumference of a 630 ft circle encompassing the proposed power block housing the reactor containment structure for new unit	The area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area
Low Population Zone	2 mile radius circle from the circumference of a 630 ft circle encompassing the proposed power block housing the reactor containment structure for new unit	The area immediately surrounding the exclusion area which contains residents
Population Center Distance	2.7 miles	The minimum allowable distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents
2.2 - Nearby Industrial, Transportation, and Military Facilities		
Elevation differential between Mississippi normal river level and ESP site.	65 ft	A bluff having an elevation differential of about 65 feet, situated between a new plant on the proposed ESP site and the normal river level.
Minimum separation distance from GGNS onsite storage of liquid hydrogen.	737 ft	Minimum distance between GGNS onsite storage of 20,000 gallons of liquid hydrogen and safety related systems of a new plant at the proposed ESPsite.

BOARD INQUIRY #6. Many items were deferred from the ESP stage with a commitment to perform/address the issue at the COL stage. Please address the following:

(A) With regards to draft SER open items:

(1) Please discuss how the open items were tracked to assured that they were resolved.

(2) Summarize any remaining open items, and highlight if these are now COL Action Items and if not, explain why not.

(B) Some items deferred to the COL stage were listed as COL Action Items, others were simply noted as future commitments, while others were made into Permit Conditions.

(1) Is there a comprehensive list of all commitments made by the Applicant and/or issues stated by the Staff in their review that were deferred from the ESP stage and are to be addressed during the COL stage (that are not already denoted as COL Action Items)? If not, please provide one.

(2) What are the criteria for determining whether to list a commitment as a Permit Condition, a COL Action Item, or just a deferred COL item?

(3) How are deferred commitments that are not listed as COL Action Items documented at this stage (so as to ensure fulfillment at the COL stage), and how will they be documented as complete during the COL stage?

(C) The SER states (p. 1-8) that the "list of COL action items is not and should not be considered exhaustive." What are the implications of this for a COL application which references the ESP? Also, are all COL action items listed in Appendix A and if not, where are they recorded?

Response:

A(1) The Staff assigned each identified open item with a number for tracking purposes. There were 23 open items at the time of issuance of the Draft SER in April 2005. These 23 items were identified, by tracking number, in Table 1.6-1 of the Draft SER. The tracking number referred to the SER section in which each open item occurred. As the Staff resolved each item, the resolution was documented in the appropriate section of the final SER.

A(2) All open items noted in the draft SER have been closed, as indicated below. Page numbers refer to the Staff's final SER.

2.1-1 Permit Condition 1 cited in Appendix A

2.1-2 - closed on p 2-10.

2.3-1 - closed on p 2-34

2.3-2 - closed on p 2-37

2.3-3 - closed on p 2-38

2.3-4 - closed on p 2-39

2.3-5 - closed on p 2-62

2.4-1 - closed on p 2-74

2.4-2 - closed on p 2-76

2.4-3 - COL Action item 2.4-2 closes this (see p 2-78)

2.4-4 - closed on p 2-78

2.4-5 - closed on p 2-78

2.4-6 - closed on p 2-136

2.4-7 - closed on p 2-140

2.5-1 - closed on p 2-182

2.5-2 - closed on p 2-186

2.5-3 - closed on p 2-187

2.5-4 - closed on p 2-234

2.5-5 - closed on p 2-239

13.3-1

a. closed on p 13-45

b. closed on p 13-49

c. closed on p 13-91

d. closed on p 13-100

e. closed on p 13-103

f. closed on p 13-103

g. closed on p 13-90

h. closed on p 13-91

i. closed on p 13-92

13.3-2 - closed on p 13-49

13.3-3 - closed on p 13-53

13.3-4 - closed on p 13-90

B(1) There is no separate list of commitments made by the Applicant. The Staff is recommending that the Permit Conditions and COL Action Items identified in Appendix A of the SER be included as part of any ESP granted for the Grand Gulf site. COL action items should be addressed in the COL applicant's site specific Final Safety Analysis Report. COL action items constitute information requirements, but are not the only acceptable set of information in the FSAR. An applicant may depart from or omit these items, provided that the departure or omission is identified or justified in the FSAR.

B(2) Permit conditions require future actions that, if implemented properly, will assure compliance with 10 CFR Part 100. COL Action items identify matters that a future applicant for a construction permit or operating requirement should address in a facility Final Safety Analysis Report. COL action items constitute information to be reviewed. The Permit Conditions and COL Action Items listed in Appendix A to the SER will be included in any ESP for the Grand Gulf site.

B(3) There are no deferred commitments that are not either Permit Conditions or COL Action items. At the COL stage the Applicant is required to meet NRC regulations and any requirements imposed by the ESP.

(C) This sentence must be taken in the context in which it was presented. The sentence preceding it reads: "The Staff identified COL action items with respect to individual site characteristics to ensure that particularly significant issues are tracked and considered during the COL or CP stage." In this context, the sentence is saying that the COL Action Items listed in Appendix A do not constitute the entire body of actions that must be addressed before granting a COL; rather, they constitute the body of action items that should be addressed relative to specific site characteristics before granting a COL.

<u>BOARD INQUIRY #12</u>. The SER states that the Applicant did not identify any physical characteristics unique to the proposed ESP site that could pose a significant impediment to the development of emergency plans. Explain how the Staff verified the accuracy of and evaluated this representation.

Response:

The site suitability determination regarding emergency preparedness must identify physical characteristics unique to the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans. As part of its review, the Staff found that the proposed ESP site currently hosts an operating reactor. The GGNS site already has integrated onsite and offsite radiological emergency plans approved by NRC. Any additional reactors in the GGNS site vicinity would use the existing GGNS 10-mile and 50-mile EPZs.

As outlined in RS-002, "Processing Applications for Early Site Permits" (ML032340334), the Staff performed its site suitability emergency preparedness review using Supplement 2 to NUREG-0654/FEMA-REP-1, "Criteria for Emergency Planning in an Early Site Permit Application" as the primary guidance for the review of radiological emergency preparedness information and plans submitted with an ESP application pursuant to Subpart A of 10 CFR Part 52.

In accordance with Supplement 2 of NUREG-0654/FEMA-REP-1, the Applicant provided a preliminary analysis, based on the May 2003 ETE Study for the existing reactor (GGNS Unit 1), that addressed evacuation times from various sectors and distances within the 10-mile plume exposure pathway EPZ and potential physical characteristics that may pose significant impediments to the development of emergency plans. The Staff's evaluation in Section 13.3 of the SER was performed using the general guidance contained in NUREG/CR-4831, "State of the Art Methods for the Development of Evacuation Time Estimate Studies," and Appendix 4 to NUREG-0654/FEMA-REP-1. The Staff's evaluation also considered modest population growth projected through 2030, as well as ongoing and scheduled improvements to major roadways currently used for evacuation.

Among the review activities, the Staff performed an independent evaluation of evacuation time estimates, demography, topography, land characteristics, and access routes, in conjunction with PNNL and DHS, and supplemented its review with a site visit and discussion with offsite emergency planning authorities. The Staff concluded that (1) the size and configuration of the plume exposure pathway EPZ reflect local emergency response needs and (2) the proposed ESP site poses no significant impediment to the development of emergency plans.

BOARD INQUIRY #17. If the Staff were to evaluate all of the meteorological data, hurricane frequencies, etc. (see, e.g., SER pp. 2-33, 2-41), in terms of periodic increments, would it show a trend with the more recent years being more severe? Would this be indicative of climate change effects?

Response:

The Staff's response to Inquiry #17 is presented in two sections. The first presents an evaluation of periodic trends within meteorologic data used throughout the SER, while the second section discusses the possibility that these trends may be indicative of climate change effects.

1. Meteorological Data Periodic Trends

The Staff considered frequency and/or intensity changes in hurricanes, tornadoes, temperatures, and precipitation patterns as an appropriate measure for severity. Using a periodic time averaging statistical approach, no significant long-term trends were observed for tornadoes, precipitation, or local temperature on which to base definitive conclusions. However, analysis of recent Atlantic basin hurricane activity and mean global temperatures show a definite increase in severity over the more recent years.

a. Hurricanes

After the hurricane seasons of 2004 and 2005, scientific interest in changes of hurricane frequency and intensity increased dramatically. These two seasons of increased activity brought a total of 43 storms in the Atlantic basin, of which 13 were major storms (e.g., category 3 or higher). Notably, the year 2005 is recognized as the most active recorded season of all time for hurricanes. The most infamous of these storms is Hurricane Katrina because of its strength and societal impact on the U.S.

Figure 1 shows four moving averages of varying time scales, including 5-year, 10-year, 15-year, and 20-year averages of Atlantic basin hurricane frequencies from 1948 through 2005. These data are taken from the National Climatic Data Center (NCDC) (Ref. 1). Since 1995, there is a definite increasing trend in hurricane frequency. On average, there have been around three additional hurricanes each year.

Figure 2 shows both the frequency and intensity of Atlantic basin hurricanes from around 1850 through 2005. There seems to be an observable decadal and multi-decadal fluctuation of hurricane activity. The more recent years, post-1995, show a slight increasing trend in severe hurricanes (e.g., category 4 and 5). From this graph, it is apparent that both hurricane frequency and intensity have increased in the Atlantic basin in recent years.

b. Tornadoes

Another natural phenomena which represents a meteorological threat to nuclear power plant safety are tornadoes. Regulatory Guide 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," provides the applicant specific guidance on how to protect against tornado impacts on safety.

To investigate potential changes in tornado frequency and/or intensity, the Staff used the National Oceanic and Atmospheric Administration's (NOAA) Storm Prediction Center's (SPC) tornado climatology (Ref. 2). This climatology includes over 47,000 tornado reports throughout the United States from 1955 to 2004. Tornado intensity, length, width, and path length are all included as part of the climatological record. These data provide the Staff a powerful tool for investigating tornado-related climate changes.

Figure 3 shows a steady increase in all tornado reports (F0 – F5) throughout the U.S. from years 1955 through 2004. If only strong tornadoes (F3 – F5) are considered, as shown in Figure 4, it is clear that there are no increasing trends in severity of tornado activity, especially in the more recent years where occurrences of strong tornadoes have decreased. The last documented F5 tornado to strike within the U.S. occurred on May 3rd, 1999, in Moore, Oklahoma.

c. Temperature Changes

Global temperatures on average are increasing. The Earth's average near-surface atmospheric temperature rose 0.6 ± 0.2 °C (1.1 ± 0.4 °F) in the 20th century. Figure 5 shows the annual and 5-year average annual mean global temperatures (Ref. 3). There is an apparent increasing trend, with a slight decline approximately every 50 years (i.e., multidecadal trend). Figure 6 shows temperature anomalies (e.g., departure from climatological averages) for the 10-year period from 1995 through 2004 (Refs. 4, 5, 6). There is an average anomaly of 0.25 °C across the southeastern United States indicating slight increases (0 to 0.5 °C) across that region of the globe. Some regions are increasing or decreasing by as much 2 °C.

Figure 7 is an analysis conducted by the Staff. This figure includes moving averages of the yearly mean daily maximum and minimal temperatures and the yearly extreme maximum and minimum temperatures near the site. These data are from the Port Gibson, MS cooperative observer station (Ref. 7), which is located approximately 6 miles from the Grand Gulf ESP site. Mean annual temperatures recorded at Port Gibson during the period 1891 - 2005 show no significant fluctuations. The yearly mean daily maximum and minimum temperatures have only deviated about 1 - 2 degrees Fahrenheit from their 100-year normal. The extreme maximum annual temperatures at the site actually reveal a decreasing trend over the past 100 years, while the extreme minimum annual temperatures at the site have increased post-1990. Neither of these trends are considered severe on a local level.

d. Precipitation Changes

Most scientists believe that, on average, global precipitation will increase with increasing temperatures. Warmer temperatures lead to more evaporation of water from the oceans, the ability for the atmosphere to hold more moisture, and increased temperature gradients (i.e., "baroclinicity") which can produce more vigorous storms. The IPCC 2001 Climate Change Report says more intense rainfall events are "very likely" over the duration of the 21st century over most areas.

Figure 8 shows precipitation trends for the continental U.S. over the past 100 years. On average, precipitation has increased; however, regional effects vary significantly. Some areas have actually seen a decrease in precipitation.

Figure 9 shows site-specific precipitation changes, including snowfall, for Port Gibson. Over the past 100 years, there has generally been an increase in average annual precipitation by approximately 15 percent. The process is very gradual, with no increasing severity over the most

recent years. The precipitation amounts have increased on average around the site around 5 – 7 inches per 100 years. There has been a slight decrease in average annual snowfall amounts. At the Grand Gulf site, snow is not a major concern because of the very low amounts received annually. Figure 9 also shows no significant changes in the extreme daily precipitation events per year near the site.

2. Evidence of Potential Climate Change Effects

Climate change refers to the variation in Earth's global climate or regional climates over a certain time period, usually several decades or longer. Changes may be driven by cyclical processes internal to the Earth, changes in external forces (e.g., sun activity), or human activity. Recently, the focus has been on human-related causes from pollution effluent releases. However, most scientists agree that the effects of potential climate change can only be observed through long-term averages (i.e., several decades or longer), as those examined for the meteorological data in the previous section.

a. Hurricanes

One of the most common arguments against variations in hurricanes due to climate change is the concept of a natural cycle of hurricane activity. However, this phenomena is highly argumentative as represented by divergent comments among top hurricane experts in the field, as highlighted in the following table.

Natural Cycles versus Global Warming	
Natural Cycle Advocates	**Global Warming Advocates**
Dr. William Gray [Emeritus Professor, Colorado State University] – "There's definitely a big multi-decadal cycle going on." "This isn't global-warming induced; this is natural." [1]	**Dr. Kerry Emanuel** [Professor, Massachusetts Institute of Technology] - "No evidence for natural cycles in late summer tropical Atlantic." [1]
Dr. Chris Landsea [Research Meteorologist, Hurricane Research Division] – "The evidence is quite strong and supported by the most recent credible studies that any impact in the future from global warming upon hurricane will likely be quite small." "I'm not convinced that it's happening." [2]	**Dr. Peter Webster** [Professor, Georgia Institute of Technology] - "What I think we can say is that the increase in intensity is probably accounted for by the increase in sea-surface temperature, and I think probably the sea-surface temperature increase is a manifestation of global warming." [3]
The superscript for each comment refers to a specific reference: **1** - (Ref. 8); **2** - (Ref. 9); **3** - (Ref. 10)	

Thus, there is an apparent lack of consensus on the issue of hurricane frequency and intensity changes influenced by global warming. The reason for fluctuation in hurricane activity is unknown. One theory, from Dr. William Gray [Emeritus Professor, Colorado State University], is that changes in the salinity of the Atlantic are a major factor in the cycles. When the salt content is higher, the ocean is warmer and more storms form. This is commonly referred to as the Atlantic Multi-decadal Oscillation (AMO). It takes decades for this cycle to complete itself.

These findings lead the NRC Staff to conclude that evidence of the effects of climate change on hurricanes is inconclusive. However, there is a notable increasing trend on both the occurrence and intensity of these storms. Because of the "potential" impacts of climate change on hurricanes, the Staff plans to stay fully cognizant of hurricane-related climate research.

b. Tornadoes

There appears to be minimal to no relationship between tornado frequency and/or intensity as it relates to climate change. Also, the frequency of the largest and/or most damaging tornadoes has seemed to decrease.

When evaluating the data found in Figure 3, there seems to be a strong signal indicative of climate change; however, most scientists agree there are other more appropriate explanations. The increase in the number of tornadoes is most likely from an increased population density (e.g., less tornadoes go unnoticed), misclassification of tornadoes (e.g., false reports), and better observational tools (e.g., radar, satellites, etc.) (Ref. 11).

The Intergovernmental Panel on Climate Change (IPCC) also states that tornadoes are not changing in frequency and/or intensity due to climate change. In their 2001 Climate Change Report (Ref. 12), they affirm that recent analyses of changes in severe local weather (tornadoes, thunder days, lightning and hail) in a few selected regions provide no compelling evidence for widespread systematic long-term changes.

Because of the reasons discussed above, the Staff has the current position that recent upward trends in the frequency of tornadoes is not related to climate change.

c. Temperature Changes

The IPCC 2001 Climate Change Report states that most of the warming over the past 50 years is attributable to human activities. The IPCC has predicted that global temperatures may increase through the year 2100 (Ref. 12). There is inherent uncertainty when estimating future greenhouse gas emissions and predicting climate sensitivities. Although most agree global temperatures are increasing, scientists disagree on the potential severity of the consequences associated with such an increase.

Climate change is most noticeable on a global scale. At regional and local levels, it becomes harder to estimate potential changes due to global warming. Although the U.S. Environmental Protection Agency (EPA) states that most of the United States is expected to warm (Ref. 13), no significant temperature trends were noticed in the local temperature data from Port Gibson.

Therefore, despite increasing global temperatures, the level of uncertainty, especially at the local scale, is too substantial, and differing scientific opinions on potential consequences are currently too numerous to draw any definitive conclusions.

d. Precipitation Changes

The EPA states, "for specific locations it is currently impossible to confidently project even the direction, let along the magnitude or timing, of the seasonal or even annual changes in precipitation" (Ref. 13). Our findings reiterate these statements, yielding to no conclusive argument that climate change has affected precipitation rates in the localized area of the Grand Gulf ESP site.

3. Conclusions

After an evaluation of regional hurricane/tornado frequencies and meteorological data (i.e., temperature and precipitation) in the vicinity of the Grand Gulf ESP site, the Staff concludes that there is no definitive trend in tornadoes, precipitation, or local maximum/minimum temperatures in recent years that is indicative of climate change effects. Although hurricane activity has both increased in frequency and intensity and mean global temperatures have steadily increased, they do not authenticate the effects of climate change, particularly on the local area of Port Gibson.

It is noteworthy to state that the conclusions presented in this response are based on current evaluations. If the local climate changes, compliance with the ESP will be reevaluated. Based on the "potential" future impacts of climate change on nuclear power plants, the Staff has included the following statement in the Grand Gulf SER:

> The staff acknowledges that long-term climatic change resulting from human or natural causes may introduce changes into the most severe natural phenomena reported for the site. However, no conclusive evidence or consensus of opinion is available on the rapidity or nature of such changes. If, in the future, the ESP site is no longer in compliance with the terms and conditions of the ESP (e.g., if new information shows that the climate has changed and that the climatic site characteristics no longer represent extreme weather conditions), the Staff may seek to modify the ESP or impose requirements on the site in accordance with the provisions of 10 CFR 52.39, "Finality of Early Site Permit Determinations," if necessary, to bring the site into compliance with Commission requirements to assure adequate protection of the public health and safety.

References

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Figures

1. Moving averages of varying time scales (5,10,15, and 20-year) of Atlantic basin hurricane frequency from 1948 - 2005.

2. Frequency of tropical storms in the Atlantic basin (1 and 5-year average) from 1850 - 2005.

3. Number of tornado reports from 1950 - 2005 for the continental United States.

4. Number of strong to violent (F3 - F5) tornadoes from 1950 - 2005 for the continental United States from March - August.

5. Estimated global temperature anomalies from 1857 - 2005.

6. Global temperature anomalies for 1995 - 2004 using a climatological mean from 1940 - 1980.

7. Moving averages (5,10,15-year) of the yearly mean daily maximum and minimum temperature and the yearly extreme maximum and minimum temperature at Port Gibson, MS.

8. Precipitation trends for the U.S. from 1900 - 1994 (Converted to %/century).

9. Moving averages (5,10,15-year) of the yearly total precipitation and total snowfall and the yearly extreme daily precipitation at Port Gibson, MS.

BOARD INQUIRY #36. There appear to be some inconsistencies when discussing the geologic strata at the site:

(A) Some sections mention that the plant will be founded on the Catahoula Formation and other sections mention the Upland Complex.

(B) There are various representations of geologic strata beneath the site (e.g., description on page 2-161, 2-196-97; SSAR figures 2.4-37, 2.5-76). Please discuss.

(1) The discrepancies between these representations and describe further the relationship between terrace deposits and the Upland Complex.

(2) The difference between the "Old Alluvium" and the "New Alluvium" and verify that they both are part of the Upland Complex.

Response:

(A) At the time that the Applicant filed this ESP application, it had not decided which reactor model would be constructed at the site. Therefore, the foundation depth is not certain, pending on additional COL investigations and reactor DCD requirements (minimum shear wave velocity requirement). In addition to this, the Applicant redefined the substratum based on the latest regional stratigraphy studies. The new classification is different from the nomenclature used in the investigations implemented for the existing nuclear power plant. Based on the correlation of the previous boring logs and ESP boring logs, the Catahoula Formation encountered in the investigations for the existing nuclear power plant is compared to the Old Alluvium of the Upland Complex. The Applicant stated in the FSAR that " the plant will be founded in the Upland Complex Alluvium, at or below the bottom of the loess deposits, at approximately elevation of 80 feet, or lower, where the average shear wave velocity exceeds 1000 ft/sec, or if the bottom of the plant is located above this elevation, that the natural soils would be excavated to this elevation and replaced with engineered fill that has a minimum shear wave velocity of 1000 ft per second." However, the statement in the SER on page 2-161, "The Catahoula Formation would serve as the load bearing stratum for the nuclear plant structures at the ESP site," should read "The Catahoula Formation as previously defined is identified as the load bearing stratum for the existing nuclear power plant."

(B) (1) On page 2-161, which is part of the Site Geology Section, the subsurface strata description is based on the Applicant's investigation summary of the Site Area (8 kilometer radius relative to the site). But on pages 2-196 to 2-197, part of the Stability of Subsurface Materials and Foundations Section, the description is more focused on the boring logs obtained right inside the site parameter. In particular, the description on pages 2 -196 to 2-197 mainly presents the Applicant's explanation of how to define the Catahoula Formation as the Upland Complex Old Alluvium based on only one well log.

FSAR figures 2.5-37 and 2.5-76 did show a variation in that Figure 2.5-37 has only the loess layer at the top of the boring but the profile in the Figure 2.5-76 shows a local artificial fill between the ground surface and the depth about 40 feet. However, the borehole was projected from 30 ft north to a center projection line; therefore, it is possible that the borehole did not encounter the artificial fill but the fill did appear along the proposed projection line.

The proposed ESP site is located on an inferred latest Pleistocene terrace surface at the elevation of 150 ft. The terrace surface is formed on the loess deposit, which is about 75 ft in thickness. The loess is underlain by Upland Complex alluvium.

(B) (2) Based on the Applicant's ESP investigation classification, the Upland Complex Alluvium has

two components: the lower Old Alluvium and the upper Young Alluvium ("New Alluvium"). The upper alluvium consists of light gray to brownish yellow sand to silt sand. And the lower alluvium consists of green to dark gray stratified thinly bedded sands, silty clays and gravels. However, in the old classification established when the existing power plant was constructed, the Old Alluvium was defined as the Catahoula Formation. SER at 2-161.

BOARD INQUIRY #53. COL Action Item 2.5-3 is a commitment to perform additional borings, laboratory testing, and a geophysical survey to define site stratigraphy.

(A) Explain your rationale in evaluating whether there is sufficient information to evaluate potential fatal flaws for the ESP license.

(B) Are all the different needs for additional subsurface information (e.g., aquifer boundaries, perched zones, hydraulic parameters, geotechnical engineering parameters, stratification delineation, observations of potential faulting in the Pleistocene deposits, defining the limits and properties of the fill, etc.) sufficiently stipulated in this COL Action Item to assure that they will be made at the COL stage?

(C) Are three borings a reasonable representation of standard practice for indicating site variability to assure no fatal flaws in the acceptability of the ESP, specifically the impracticability of delineating, removing or bypassing all material with <1000 fps shear velocity?

Response:

(A) The limited site information provided for the ESP evaluations indicates that the site most likely satisfies the minimum characteristics considered important to the seismic evaluations and plant capacity. At the COL stage, further detailed site evaluations need to be performed to ensure that the site characteristics satisfy the minimum parameters of interest. The evaluations of the design of specific standard plants indicated that the satisfaction of these parameters will not leave "fatal flaws" in the designs.

(B) Appendix D to Regulatory Guide (RG) 1.132 provides guidelines for the spacing and depth of subsurface explorations for safety-related foundations. During the COL stage, the Applicant needs to meet the RG 1.132 guidelines when the additional borings are taken. Therefore, the Staff considers that all the different needs for additional subsurface information described in the question are sufficiently stipulated in COL Action Item 2.5-3 to assure that they will be made at the COL stage.

(C) Three borings are clearly not acceptable to eliminate the potential for "fatal flaws." A detailed site investigation program still needs to be conducted to ensure that the minimum site conditions required for a given plant design are satisfied.

(D) For evaluation of critical facilities, a "geophysical survey" is typically understood to consist of a number of individual investigation programs.

BOARD INQUIRY #56. Statements of site stability seem to be contradicted by the observed slough in the loess.

(A) Why are the slope movements on the bluff called a postulated slump instead of just a slump?

(B) To support ths ESP, what field studies have been made to investigate the stability of the bluff and creep characteristics of the loess?

C) Why isn't the existing scarp (i.e., slough) indicative of recent movements and potential bluff instabilities?

(D) The SER states that the plant will likely be setback 100' from the bluff, but the SSAR (p. 2.5-84) notes a 150' setback. How does the safety factor for stability change for the variation in these distances, and what is considered an adequate safety factor?

(E) Would the static safety factor be influenced by blast induced pressure waves and aggravated by potential liquefaction?

Response:

(A) Evidence of soil creep and slump exist in the loess soil, but are generally restricted to the face of the bluff. No indication of additional movements has been noted since construction of the existing facility. However, to evaluate the adequacy of the plant design, the issue of potential future slumps or postulated slump or slope movement needs to be evaluated to properly qualify the site.

(B) The plant foundation is expected to be situated atop the stiffer soil at depths below the loess, which is approximately 60 ft thick in and around the site. Entergy report ER-02 (Page 36) indicates that specific stability analyses will need to be performed to confirm slope stability and potential impact on the plant. For the ESP application, only simplified engineering judgments have been made using the available data from both the UFSAR and ESP data.

(C) No indications exist of any recent movements that extend into the site for distances from the edge of the bluff that may impact the facility. The existing sloughs or past movements are restricted to the edge of the bluff.

(D) Using simplified methods of analysis and assuming granular soils with no cohesive strength components, the safety factor for failure surfaces that extend to distances of from 100 ft to 150 ft can be expected to change by the order of 40% to 50%.

(E) It is anticipated that blast-induced pressure waves will not have a significant impact on slope stability. Liquefaction from such a short duration dynamic loading is not considered realistic. However, liquefaction from relative long duration seismic loads would be of more concern if seismic motions reach high levels of acceleration.

BOARD INQUIRY #69. The SER states that "In Section 2.2.1 of Part 4, the Applicant further noted that a detailed evaluation of the original 1986 ETE undertaken in May 2003 more fully considered the impact of historical population growth and transportation system improvements." This was an evaluation of the 1986 ETE, but was not identified as replacement of the 1986 ETE to bring the entire study up to date.

(A) Why was this not a full update of the 1986 ETE, and why is it acceptable to the Staff in light of the lessons learned from Hurricane Katrina?

(B) The 1986 ETE is not consistent with NUREG/CR-4831, which was published after the 1986 ETE was performed. The 2003 ETE seems to be incomplete. For example, it made no attempt to update (or review) the modeling used in the 1986 ETE study. The large number of RAIs associated with section 13.3.3.11 is indicative of the need to fully update the 1986 ETE study.

(C) Does the Staff consider this evaluation to be adequate for a COL application? If not, why is there not a COL Action Item to formally update the 1986 ETE in its entirety?

Response:

(A) The original 1986 ETE was reviewed by the NRC as part of the licensing of Unit 1 at the Grand Gulf Nuclear Station (GGNS) in accordance with the guidance provided in Appendix 4 to NUREG-0654/FEMA-REP-1, "Evacuation Time Estimates Within the Plume Exposure Pathway Emergency planning Zone." Regulatory Information Summary (RIS) 2001-16, "Update of Evacuation Time Estimates," refers to NUREG/CR-4831 for criteria to be considered in the evaluation of evacuation time estimates (ETEs). NUREG/CR-4831 provides as a general rule that a 10% increase in population may indicate a need to check evacuation times.

Section III.A of Supplement 2 to NUREG-0654/FEMA-REP-1 states that an ETE analysis can be used to assess the feasibility of developing emergency plans for a site. In Section 2.2.2 to Part 4, the Applicant stated that the 2003 ETE Study (for GGNS, Unit 1) examined evacuation time estimates as determined in the original 1986 ETE against the current GGNS emergency planning zone (EPZ) population using the 2000 U.S. Census data and projected 2002 population estimates. Revision 1 to the 2003 ETE Study indicated a population increase (from 1986 to 2002) of 11.1%. However, based on substantial improvements to major evacuation roadways since 1986, the time estimates in the 1986 ETE remained valid and, in some cases, may now actually overstate actual evacuation times. Therefore, the Applicant appropriately evaluated the impact on evacuation times in the 2003 ETE Study based on the criteria outlined in NUREG/CR-4831. As such, a complete update to the 1986 ETE is not required. See response to inquiry No. 68 concerning lessons learned from Hurricane Katrina.

(B) The 1986 ETE was performed using the guidance contained in Appendix 4 to NUREG-0654/FEMA-REP-1, which is endorsed by NRC Regulatory Guide 1.101, Revision 2. NUREG/CR-4831 (published in March 1992) is a contractor report describing approaches and providing recommendations regarding the relevant information, assumptions and methods to be used based on advances in the art of ETEs. NUREG/CR-4831 has not been formally endorsed by the NRC as an acceptable alternative to Appendix 4 to NUREG-0654/FEMA-REP-1 and, therefore, its use is not required to update original 1986 ETE modeling. The number of RAIs reflects the level of review by the Staff, in conjunction with PNNL and DHS, to clarify possible inconsistencies between ETE preliminary analysis contained in Section 2.2 to Part 4, the original 1986 ETE, and the 2003 ETE Study, and to develop a full understanding of the conclusions reached, and is not directly related to

need to perform a complete ETE update.

(C) The Staff considers the evaluation adequate to support an ESP finding that no physical characteristics unique to the proposed site exist that could pose a significant impediment to the development of emergency plans. Since the Applicant is required to submit complete and integrated emergency plans in a COL or OL application, which would include an ETE, a specific COL action item is not required.

BOARD INQUIRY #72. The SER states that the Staff agrees with the Applicant – in its response to RAI 13.3-16 and 13.3-17 – that "LOAs with private sector organizations are outside the scope of the 10 CFR 52.17(b)(3) requirement and will be provided at the COL stage."

(A) Why is this not a COL Action Item?

(B) Has the Staff evaluated the capability of these facilities to provide the expanded support needed for the additional ESP facility? Did the Staff evaluate the adequacy of the proposed training described in section 3.15 of the Applicant's ESP application?

Response:

(A) Notwithstanding any Staff approval of a proposed major feature in this SER, all features of the emergency plans requiring a description pursuant to Appendix E to 10 CFR Part 50 but that are not described in the ESP application will be reviewed in the context of a COL or OL application. The Staff will review complete and integrated emergency plans submitted in a COL or OL application to determine whether they comply with such requirements, as well as the requirements of 10 CFR 50.47. As such, the Staff does not believe that a COL action item is required.

(B) Major Feature L of Supplement 2 to NUREG-0654/FEMA-REP-1 only requires that the major features plans describe the contacts and arrangements made for local and backup hospital and medical services. Assurance that persons providing these services are adequately prepared to handle contaminated individuals is outside the scope of a major feature plan at the ESP stage. As such, the Staff will review complete and integrated emergency plans submitted in a COL or OL application to determine this capability for local and backup hospital and medical facilities based on the evaluation criteria provided in NUREG-0654/FEMA-REP-1.

Major Feature O (Radiological Emergency Response Training) of Supplement 2 to NUREG-0654/FEMA-REP-1 only requires that the major features plans describe a training program for instructing and qualifying personnel who will implement radiological emergency response plans, including specialized initial training and retraining. The scope, nature and frequency of this training is outside the scope of a major feature plan at the ESP stage. An evaluation of radiological emergency response training against the evaluation criteria in Major Feature O of Supplement 2 to NUREG-0654/FEMA-REP-1 is provided in SER Section 13.3.3.14. The Staff will review complete and integrated emergency plans submitted in a COL or OL application to determine this capability based on the evaluation criteria provided in NUREG-0654/FEMA-REP-1.

BOARD INQUIRY #81. Section 15.1 lists the DBAs that were chosen for radiological analysis. The SSAR indicates that Regulatory Guide 1.183, NUREG-0800, and NUREG-1555 were used to pick these events. The events shown in SSAR § 3.3.1 include those in Regulatory Guide 1.183 plus small line breaks outside containment. Events such as feedwater line breaks, liquid & gaseous tank Failures, reactor coolant pump shaft break and spent fuel cask drops are not included. These are identified in NUREG-0800 and also identified in the AP1000 DCD. In addition, the AP1000 DCD (see DCD §§ 15.7.3, 15.7.6) requires the COL Applicant to evaluate a liquid rad waste tank failure. What was the Staff's rationale for excluding certain events from its review?

Response:

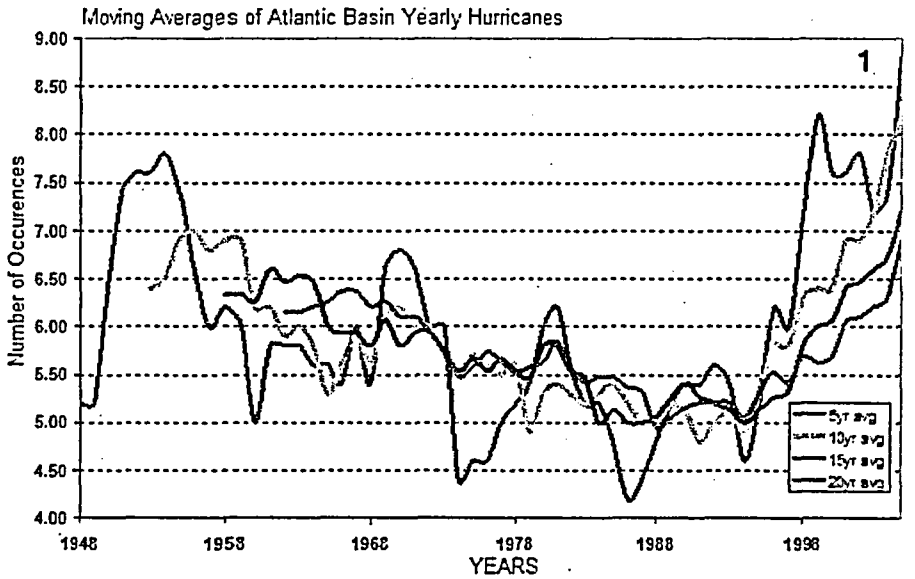
The Staff identified in its SER all of the DBAs that were listed in RG 1.183, NUREG-1555, NUREG-0800, and the ESP Applicant's SSAR.

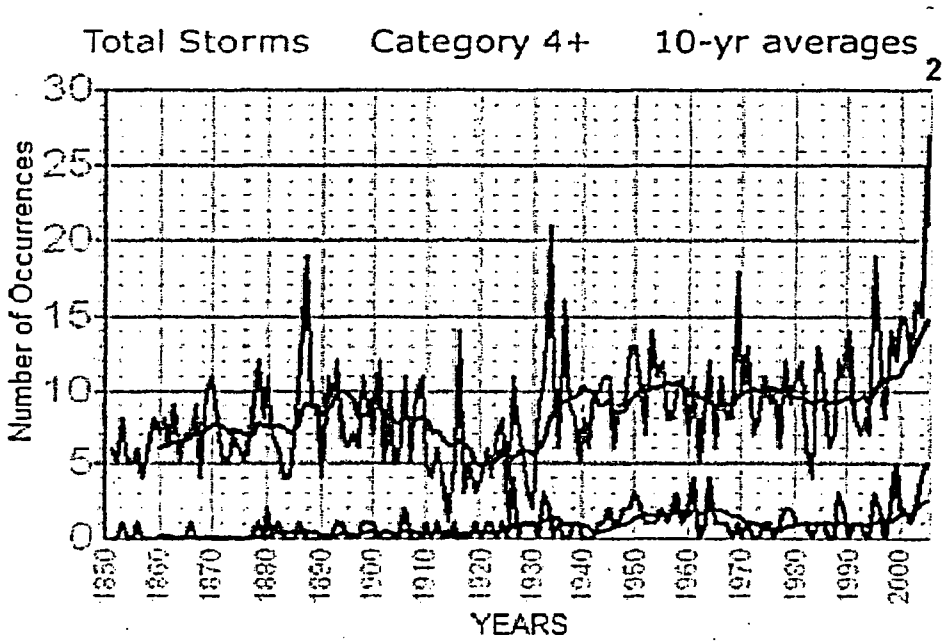
NUREG-0800, NUREG-1555, and the SER include a DBA titled "Failure of Small Lines Carrying Primary Coolant Outside Containment,"while the ESP Applicant's SSAR listed the same DBA as "Small Line Break Outside Containment." RG 1.183 does not include this event as a DBA.

Also, the "Reactor Coolant Pump Shaft Break" identified in the SER and in NUREG-1555 is the same DBA as the "Reactor Coolant Pump Locked Rotor," listed in the ESP Applicant's SSAR. It results the same radiological consequence with the same accident sequence. NUREG-0800 listed this event as "Reactor Coolant Pump Rotor Seizure and Reactor Coolant Pump Shaft Break" which postulates as an event of an instantaneous seizure of the rotor or break of the shaft of a reactor coolant pump (see NUREG-0800 Section 15.3.3 -15.3.4). Regarding the "Feedwater Line Breaks," the Staff does not consider it necessary to analyze it as a separate DBA because it is bounded by the LOCA. This event is not listed in RG 1.183, NUREG-1555, the SSAR, or the SER as a DBA. Only NUREG-0800 lists this event as Feedwater System Pipe Break Inside and Outside Containment (PWR)."

The liquid and gaseous tank failures are "Infrequent Events," and they are not DBAs for the purpose of the radiological consequence analysis because they have a limited radioactivity content controlled by plant procedures and technical specification. The spent fuel cask drop was not evaluated because it is a subset of the fuel handling accident. The liquid and gaseous tank failures and the spent fuel cask drop are not listed in RG 1.183, NUREG-1555, the SSAR, or the SER as a DBA. Only NUREG-0800 lists these events along with all other potential reactor transients including anticipated operational occurrences, infrequent events, and DBAs. Finally, the AP1000 DCD requires the COL Applicant to evaluate a liquid rad waste tank failure as a COL Action Item.

ATTACHMENT C





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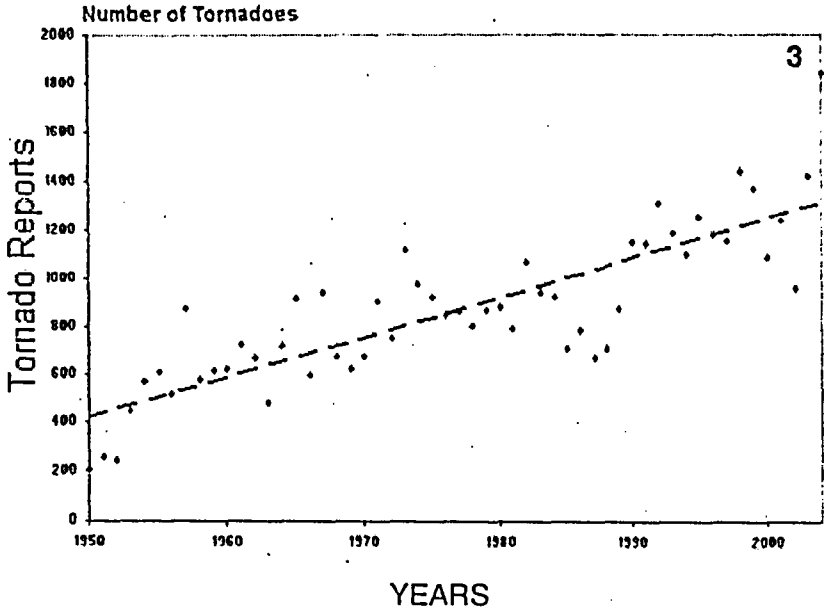
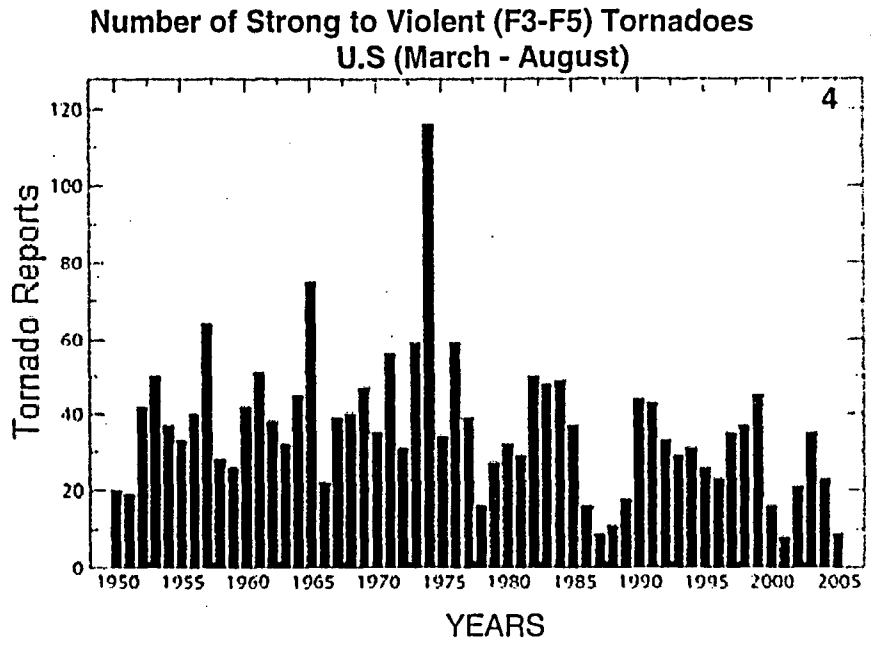
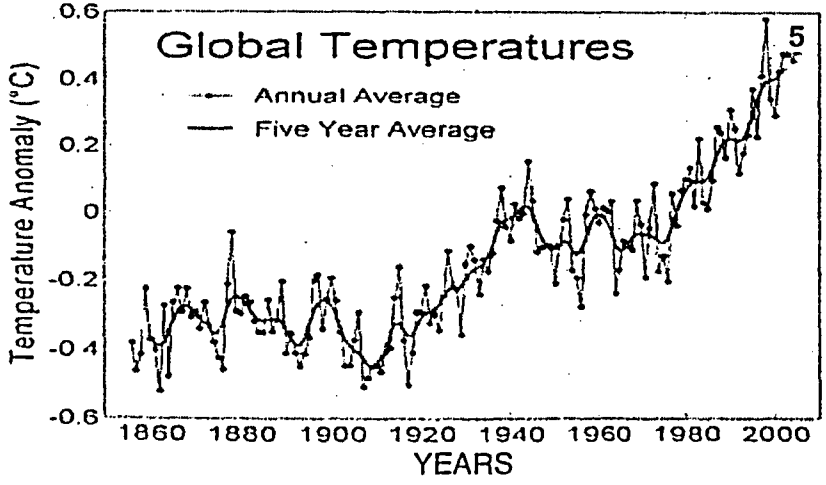
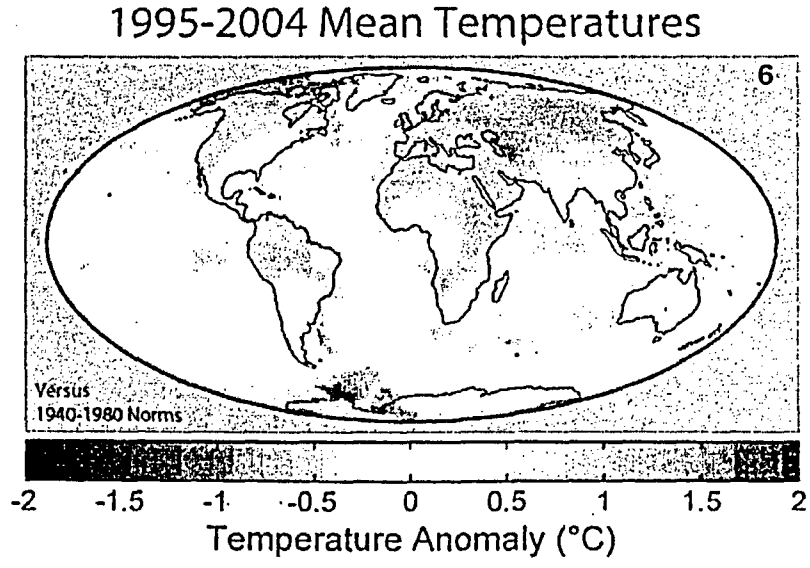
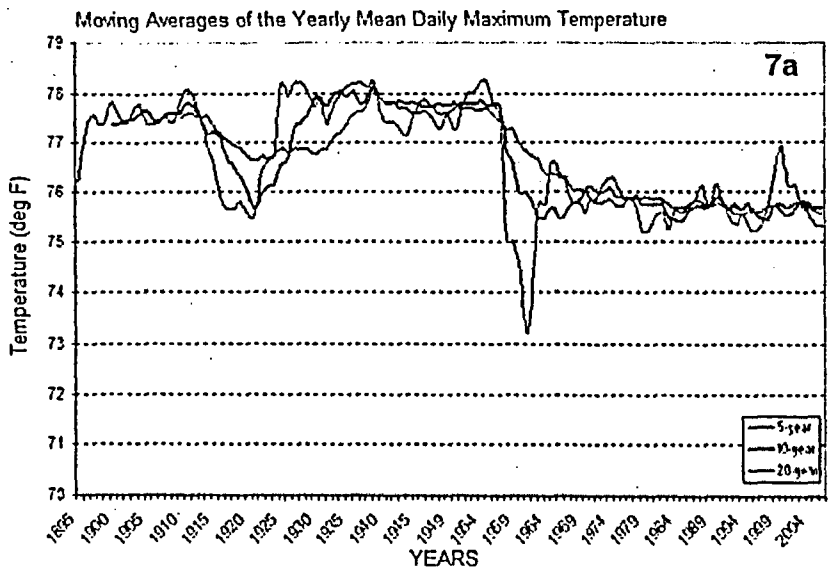
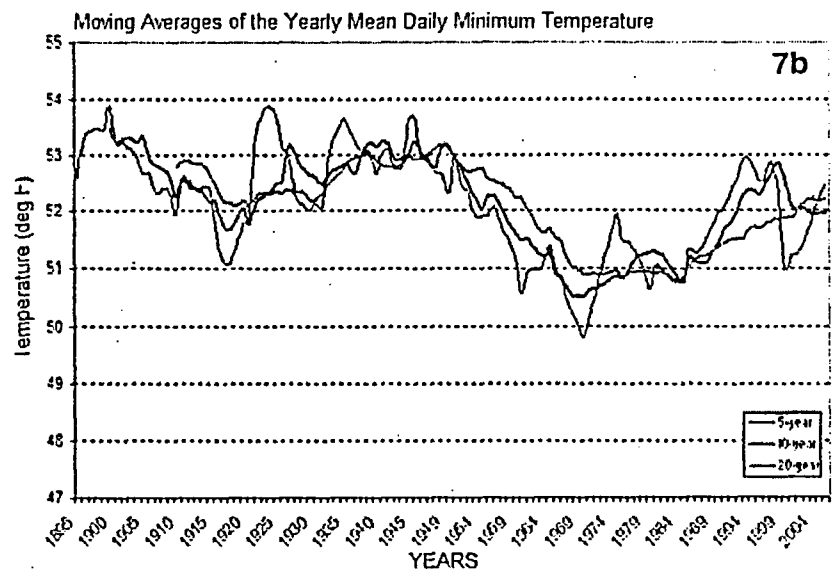

Number of Tornadoes
3
Tornado Reports
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1950
1960
1970
1980
1990
2000
YEARS

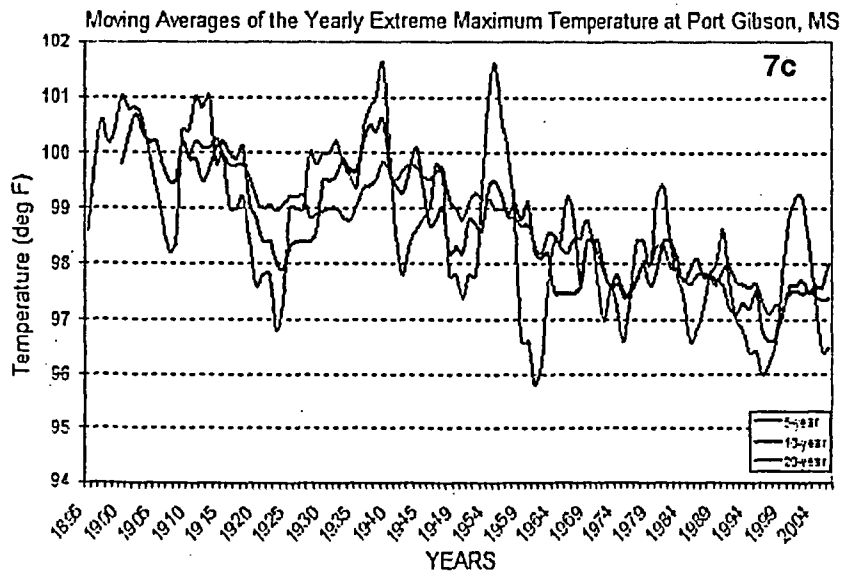

Number of Strong to Violent (F3-F5) Tornadoes
U.S (March - August)
4
Tornado Reports
120
100
80
60
40
20
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
YEARS

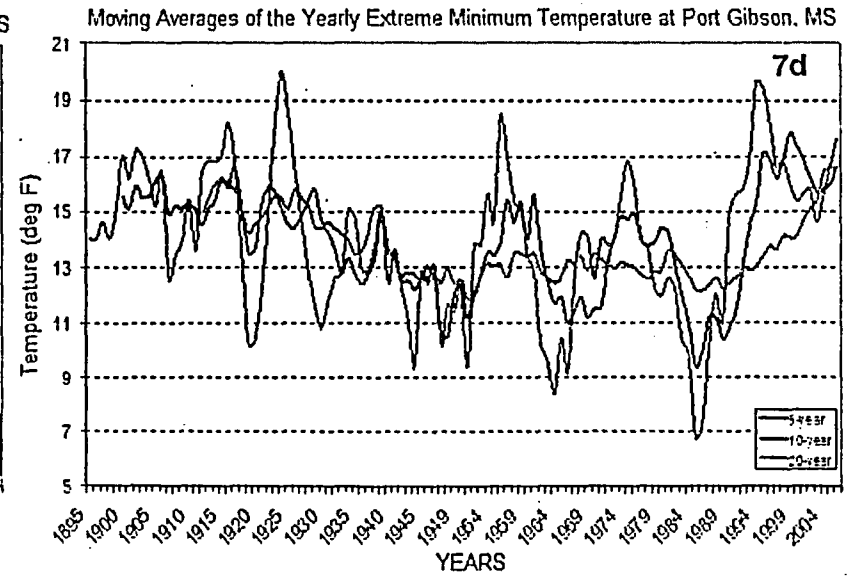

Global Temperatures
5
Annual Average
Five Year Average
Temperature Anomaly (°C)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000
YEARS


1995-2004 Mean Temperatures
6
Versus
1940-1980 Norms
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Temperature Anomaly (°C)

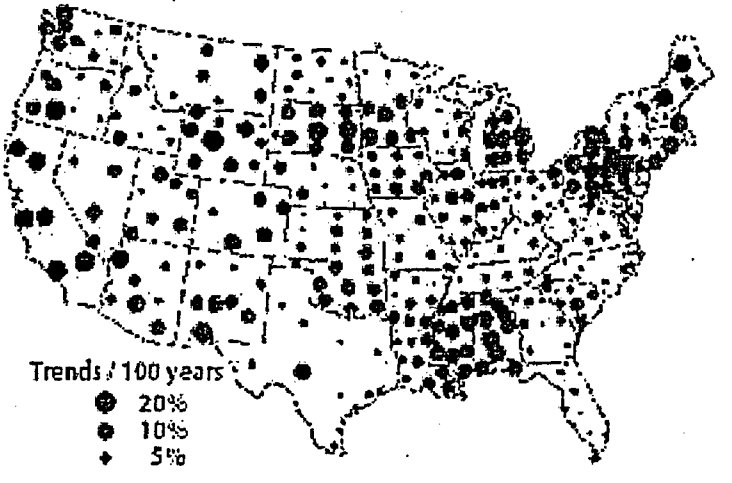

Moving Averages of the Yearly Mean Daily Maximum Temperature
7a
Temperature (deg F)
YEARS


Moving Averages of the Yearly Mean Daily Minimum Temperature
7b
Temperature (deg F)
YEARS


Moving Averages of the Yearly Extreme Maximum Temperature at Port Gibson, MS
7c
Temperature (deg F)
YEARS


Moving Averages of the Yearly Extreme Minimum Temperature at Port Gibson, MS
7d
Temperature (deg F)
YEARS

Precipitation Trends, 1900 to Present 8

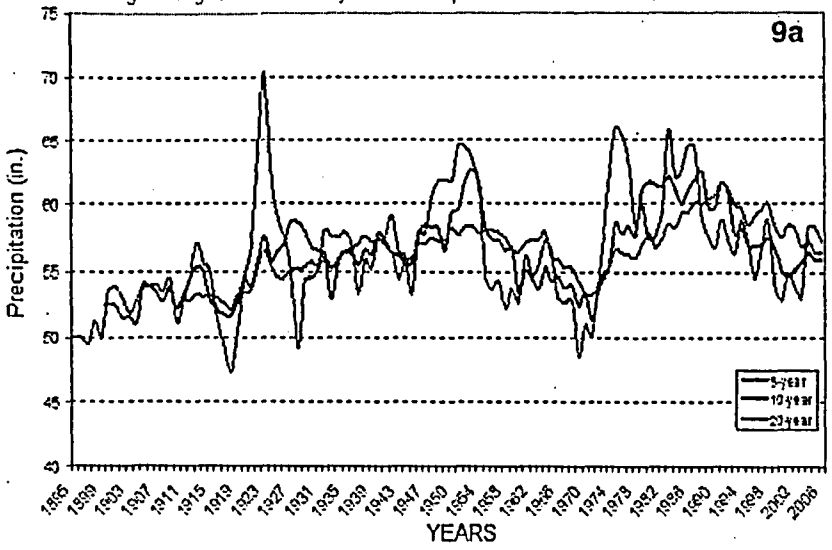


Red circles reflect increasing precipitation
Blue circles reflect decreasing precipitation

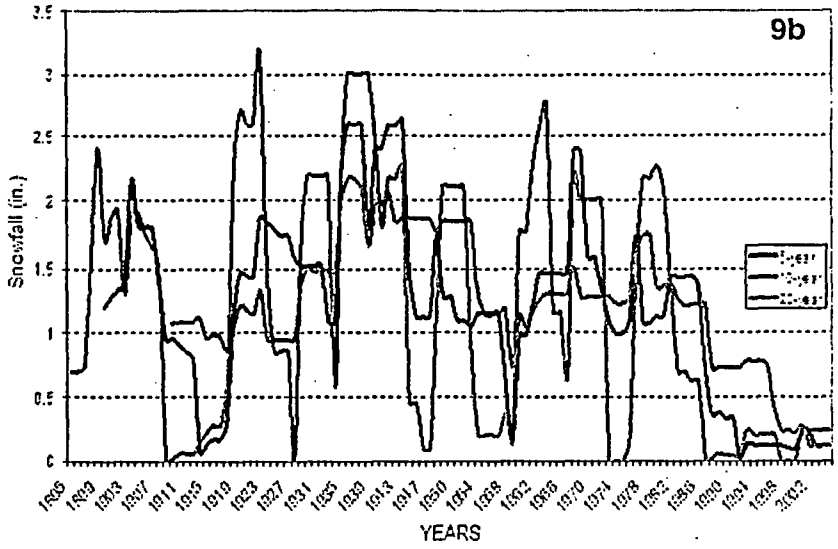
Precipitation Trends for the U.S. from 1900 - 1994 (Converted to %/century)

Source: http://yosemite.epa.gov/oar/globalwarming.nsf/content/ClimateTrendsPrecipitation.html

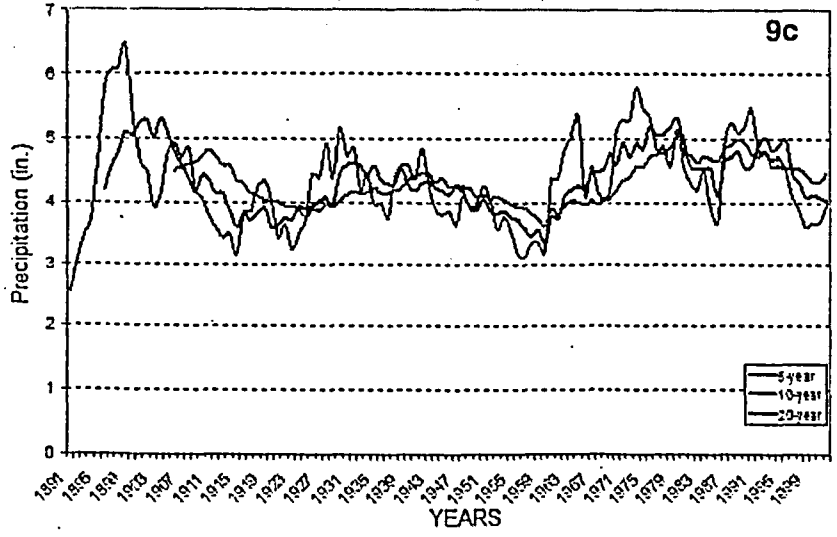
Moving Averages of the Yearly Total Precipitation at Port Gibson, MS



Moving Averages of the Yearly Total Snowfall at Port Gibson, MS



Moving Averages of the Yearly Extreme Daily Precipitation at Port Gibson, MS



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)	)	

NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney herewith enters an appearance in the above-captioned matter. In accordance with 10 C.F.R. § 2.314(b), the following information is provided:

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Admissions:	Commonwealth of Virginia
Name of Party:	NRC Staff

Respectfully submitted,

Jonathan M. Rund
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 29th day of September, 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)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF RESPONSE TO LICENSING BOARD'S ORDER OF SEPTEMBER 13, 2006" and the "NOTICE OF APPEARANCE" of Jonathan M. Rund in the above-captioned proceeding have been served on the following by electronic mail and with copies by deposit in the Nuclear Regulatory Commission's internal mail system, or as indicated by an asterisk (*), through electronic mail with copies by deposit in the U.S. Mail on this 29th day of September, 2006:

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Dr. Nicholas G. Trikouros
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