

November 20, 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 PRE-FILED TESTIMONY CONCERNING HEARING ISSUE G:  
EVALUATION OF PLANT PARAMETER ENVELOPE

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

A.1. (GW) George F. Wunder. I am employed as a Project Manager in the ESBWR/ABWR Projects Branch 1, Division of Licensing Project Management, Office of New Reactors, U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

A.1. (JW) James H. Wilson. I am employed as a Senior Project Manager in the New Reactor Environmental Projects Branch, Division of New Reactor Licensing, Office of Nuclear Reactor Regulation, NRC. A statement of my professional qualifications is attached.

A.1. (BH) R. Brad Harvey. I am a Physical Scientist in the Nuclear Regulatory Commission's (NRC's) Office of Nuclear Reactor Regulation (NRR), Division of Risk Assessment (DRA). A statement of my professional qualifications is attached.

A.1. (SK) Stephen Klementowicz. I am a Senior Health Physicist in the Nuclear Regulatory Commission's (NRC's), Office of Nuclear Reactor Regulation (NRR), Division of License Renewal (DLR). A statement of my professional qualifications is attached.

A.1. (GB) Goutam Bagchi. I am a Senior Advisor in the Nuclear Regulatory Commission's (NRC's), Office of Nuclear Reactor Regulation (NRR), Division of Engineering (DE). A statement of my professional qualifications is attached.

A.1. (JR) James V. Ramsdell, Jr. I am employed as a Staff Scientist with the Atmospheric Chemistry & Meteorology Technical Group at the U. S. Department of Energy's Pacific Northwest National Laboratory operated by Battelle. I am providing testimony under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached.

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

A.2. (GW) I took over Project Management responsibilities in May 2006, following issuance of NUREG-1840, the "Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site" ("SER"). I have been responsible for project management activities with respect to the SER since that time.

A.2. (JW) I am the NRC Senior Project Manager for the environmental review of SERI's Grand Gulf ESP application. I was responsible for overseeing the preparation of NUREG-1817, the "Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site: Final Report," April 2006 ("FEIS").

A.2. (BH) As part of the NRC staff's health and safety review of the SERI ESP application, documented in the Grand Gulf Site SER, I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned meteorology.

A.2. (SK) As part of the NRC staff's health and safety review of the SERI ESP application, documented in the Grand Gulf Site SER, I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned the radioactive waste treatment system and the radiological impacts of routine operation to plant workers and members of the public.

A.2. (GB) As part of the NRC staff's health and safety review of the SERI ESP application, documented in the Grand Gulf Site SER, I reviewed the aspects of the Applicant's Site Safety Analysis Report that concerned hydrology.

A.2. (JR) As part of the NRC staff's environmental review of the SERI ESP application, documented in the Grand Gulf FEIS, I assisted the NRC staff in its analysis of the aspects of the Applicant's Environmental Report that concerned Meteorology and Air Quality, and evaluation of Design Basis and Severe Accidents.

Q.3. In its November 6, 2006, Order, the Atomic Safety and Licensing Board ("Board") identified certain issues to be addressed in connection with the mandatory hearing. With regard to the NRC staff's evaluation of the plant parameter envelope ("PPE"), the Board stated that the list of PPE parameters provided in SERI's ESP application appears to be incomplete with respect to those identified in the Nuclear Energy Institute ("NEI") guidance. Please indicate any PPE parameters that are on the NEI list, but are not included in the PPE table for the Grand Gulf ESP.

A.3. (GW, JW) In response to the Board's question, the Applicant prepared a table identifying the NEI parameters and indicating whether each is included in the PPE table for the Grand Gulf ESP. That table is attached to this testimony as Table G-1. The Staff agrees with the Applicant's identification of which parameters from the NEI document were or were not used for the Grand Gulf application. The Staff takes no position concerning the Applicant's additional comments (column 3 of Table G-1) concerning the inclusion/exclusion of particular parameters.

Q.4. In its November 6, 2006, Order, the Board identified certain issues to be addressed in connection with the mandatory hearing. With regard to the NRC staff's evaluation of the PPE, the Board stated that the relationship between the PPE parameters provided in SERI's ESP application and the maximum MWt and MWe in the ESP analyses performed by the NRC staff was unclear to the Board. Please discuss how the staff's analyses that use the PPE parameters support the maximum site reactor power requested by the Applicant. Provide separate discussions for the FSER and the FEIS analyses.

A.4. (GW) With respect to the Staff's health and safety review and the analyses documented in the FSER, the Staff believes that the PPE parameters in the Grand Gulf ESP PPE that are directly related to the site power level are not inconsistent with the maximum site reactor power requested by the Applicant.

(GB) For example, the bounding parameter for maximum makeup water flow (78,000 gpm) is not inconsistent with the proposed maximum site reactor power.

(BH) Regarding the parameters related to Normal Plant Heat Sink Condenser and Normal Heat Sink (NHS) Cooling Towers in PPE Sections 2.3.2, 2.4.8, and 2.5.8, as well as the parameters related to the Unit Vent/Airborne Effluent Release Point in PPE Sections 9.4.2 Elevation (Normal), 9.4.3 Elevation (Post Accident), and 9.4.4 Minimal Distance to Site Boundary, these PPE parameters are not inconsistent with the Applicant's proposed maximum site reactor power.

(SK) Likewise, for the evaluation of the radiological impacts to plant workers, members of the public, and the environment, the Staff used SERI's bounding radiological routine effluent release source term. The source term was stated by SERI to be the maximum value for any of the plant design / number of unit combinations being considered for the site. This value is not inconsistent with the Applicant's proposed maximum site reactor power.

(GW) In summary, with respect to the Staff's health and safety review and the analyses documented in the FSER, the Staff believes that the PPE parameter values in the Grand Gulf ESP PPE that are directly related to the site power level are not inconsistent with the maximum site reactor power requested by the Applicant.

A.4. (JR) With respect to the Staff's environmental review and the analyses documented in the FEIS, the Staff believes that the PPE parameters in the Grand Gulf ESP PPE that are directly related to the site power level are not inconsistent with the maximum site reactor power requested by the Applicant.

The Staff's analyses in the FEIS are based on either 1) specific reactor designs (e.g., the ABWR and the AP1000), or 2) composite characteristics that are derived from consideration of the individual characteristics of each of the 7 reactor designs listed in the Application. The site goal is generation of about 2000 MWe. None of the reactors discussed in the Application is capable of generation of 2000 MWe. Therefore, at least two reactors would be necessary to meet that goal.

Of the reactors discussed, the ABWR is the largest, with a postulated rating of about 1500 MWe based on a design power level of 4300 MWt. Thus, the PPE (ER Table 3.0-1) lists 4300 MWt as a unit specific parameter. The corresponding site value (not included explicitly in the PPE) is 8600 MWt. The PPE contains several parameters that are directly related to the site power level. These parameters include normal heat sink blowdown flow rate, evaporation rate, and makeup water flow rate. The ABWR was considered in establishing these parameters. Consequently, the Staff assumes that the values given in the PPE encompass the heat rejection needs of two 4300 MWt ABWRs.

Normal heat sink blowdown flow rate, evaporation rate, and makeup water flow rate were considered in the evaluation of the impacts of plant operation on water use and quality. A similar set of parameters is associated with the ultimate heat sink. The ultimate heat sink would

have lesser impacts on the environment. Makeup water and blowdown flows were considered along with blowdown temperature (which is not likely to be related to power) in evaluation of the impacts of the postulated facility on aquatic ecology. Intake and outfall design characteristics not related to power level may have impacts on aquatic ecology that are as large as those related to power level.

Land use and terrestrial ecology impacts related to site power level are not likely to be particularly sensitive to the ultimate site power level, except to the extent that they will be impacted if the ESP site power level exceeds the capacity of the existing transmission system. If transmission capacity is exceeded and additional capacity installed, further increases in the size of the plant are not likely to have proportionately large increases in impacts.

Although radiological releases are affected somewhat by design power level, use of the PPE as implemented by SERI negated any effect that design power level might have. The radiological releases from plants are determined by plant systems and release paths as much as by the design power level.

SERI included tables of gaseous (Table 3.0-7) and liquid (Table 3.0-8) radiological releases expected during normal operations in its PPE. These tables are based on radionuclide-by-radionuclide comparison of projected releases from each of the 7 reactor designs being considered. For each radionuclide, the largest release from among the 7 designs was entered into the tables. Therefore, the PPE normal-operations source terms in these tables bound the source terms for all 7 reactor designs, including the ABWR. The source term for any other reactor design should be compared against the source terms in the tables on an isotopic basis to determine if the source terms are bounded by the FEIS analysis. Reactor power rating is not an appropriate basis for making this determination.

Comparisons of isotopic release rates and doses are more appropriate means of establishing whether a reactor design is within the bounds of the Staff's analysis than is reactor

design power. Design basis accidents and severe accidents were evaluated for both the ABWR and AP1000 reactor designs. The ABWR has a higher thermal power than the AP1000. However; the consequences of ABWR design basis accidents are not necessarily greater than those of AP1000 design basis accidents.

In summary, with respect to the Staff's environmental review and the analyses documented in the FEIS, the Staff believes that the PPE parameter values in the Grand Gulf ESP PPE that are directly related to the site power level are not inconsistent with the maximum site reactor power requested by the Applicant.

Q.5. In its November 6, 2006, Order, the Board identified certain issues to be addressed in connection with the mandatory hearing. With regard to the NRC staff's evaluation of the PPE, the Board requested that the staff identify and discuss any differences or inconsistencies in the treatment of the PPE between the FSER and the FEIS.

A.5. (GW, JW) The Staff does not believe that there are "inconsistencies" in the FSER and FEIS treatment of the PPE. However, in general terms, there are some fundamental differences between the approaches used for the FSER and the FEIS; these differences influence, among other things, why the Staff analyzes the PPE values for a particular component of its review. The sources of these differences are the statutory and regulatory requirements for each review. The Staff's safety review is performed under the Atomic Energy Act and in accordance with the regulations in 10 C.F.R. Part 52. The environmental review is performed under NEPA as implemented in NRC regulations at 10 C.F.R. Part 51. Whereas the safety review is focused primarily on protecting the health and safety of the public, the environmental review considers a much broader range of impacts to the environment as a whole. This broader range of impacts is reflected in the longer set of PPE values relevant to the environmental review.

Appendix I of the FEIS presents the PPE submitted by the Applicant in its ER. The listing is not a complete listing of plant parameters, but is a listing of the plant parameters that the Applicant considered relevant to the environmental review (ER page 3.1-1). Similarly, the PPE listing in the SSAR includes only those plant parameters relevant to the site-suitability evaluation (SSAR page 1.3-5). The PPE tables in the SER and EIS agree for those parameters that are found in both.

In its safety review, the Staff reviewed the Applicant's PPE parameters to evaluate site-related aspects of plant design, in order to determine whether the site characteristics would be consistent with a design that might be described in an eventual COL application. Consequently, the Staff's safety analysis focused on how the site would meet the functional or operational needs of a potential future unit (or units), as well as the capability of the facility to withstand any site environmental hazards (natural and man-made). In contrast, the Staff's environmental review focused on evaluating the environmental impacts of construction and operation of a nuclear unit or units at the proposed site if the characteristics of those units were within the parameter values defined in the PPE. The intent of the Staff's environmental review is to provide a bounding estimate of the environmental impacts that might occur at the Grand Gulf ESP site.

In other words, an important reason for the differences in approach between the FEIS and the FSER is the matter of perspective. For example, both the FEIS and the FSER consider impacts related to hydrology. But in these two documents, the Staff is looking at hydrology for very different reasons. In the FEIS, the Staff is evaluating the impacts on the hydrology of the surrounding area of constructing and operating a nuclear plant (or plants). In the FSER, in contrast, the Staff is evaluating the potential impacts of local hydrology on the plant. Thus, in one case the Staff is looking from the inside out, and in the other case it is looking from the outside in. This difference in perspective leads to very different evaluations in relation to the



same resource. Specifically, the analyses in the FSER address, for example, concerns related to the probable maximum flood, an issue unrelated to the environmental review. On the other hand, the analyses in the FEIS address concerns related to issues such as reduced streamflow downstream of the plant.

More generally, for an environmental review under NEPA and Part 51 the Staff evaluates the reasonably foreseeable impacts. In addition, the Staff has the latitude, if numerical data are not available, to qualitatively evaluate the impacts.<sup>1</sup> In contrast, the safety review generally focuses on the results of conservative analyses. As an example, in considering  $\chi/Q$  values the Staff used "typical" meteorological conditions in the FEIS (see FEIS at 5-63). "Typical" is defined as those conditions that give atmospheric dispersion factors that are exceeded [i.e., dispersion is less and dose is higher] 50 percent of the time. In contrast, for the Chapter 15 analyses in the FSER, the Staff used values for  $\chi/Q$  associated with "adverse" meteorological conditions (defined as those conditions that give atmospheric dispersion factors that are exceeded no more than 5 percent of the time).

In summary, because of the differences in the basic goals of the analyses in the FEIS and the FSER, there are differences not only in the data used and the approaches applied by the Staff in the analyses, but also in the significance of particular PPE values to those analyses. Based upon the reasoning described above, these differences are to be expected between the FEIS and FSER reviews, including in the Staff's analyses of the particular PPE parameter values and their relevance to the respective safety and environmental conclusions.

Q.6. In its November 6, 2006, Order, the Board identified certain issues to be addressed in connection with the mandatory hearing. With regard to the NRC staff's evaluation

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<sup>1</sup> As stated in 10 C.F.R. § 51.71(d), "The analysis for all draft environmental impact statements will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms."

of the PPE, the Board requested that the staff discuss the completeness of the PPE parameters for the Grand Gulf ESP and why it is acceptable for the Grand Gulf PPE to provide only a subset of the parameters identified in NEI 01-02.

A.6. (GW) The Staff determined that all of the parameters necessary for the health and safety evaluation of the Grand Gulf ESP PPE were included in the Application and, based on its experience and judgment, including extensive experience with the characteristics of operating reactors, the Staff determined that the values selected for those parameters were not unreasonable.

(JW) The Staff determined that all of the PPE parameters necessary for the Staff's independent evaluation of the Environmental Report for the Grand Gulf ESP were included in the Application or were obtained from reconnaissance-level information gathered in the course of the Staff's environmental review. Based on its experience and judgment, including extensive experience with the characteristics of operating reactors, the Staff determined that the values selected for those parameters were not unreasonable.

(GW, JW) The Staff notes that it has not formally endorsed NEI-01-02, and thus the set of parameters identified in that document is not binding on the Staff in its review of PPEs, including the PPE for the Grand Gulf ESP. In any event, the NEI-01-02 PPE is not intended to represent any specific site or design. Individual PPEs are based on the unique analysis of data needed to support a particular ESP. Although NEI-01-02 identifies other parameters that could be used in generating a PPE, the Staff does not agree that an ESP applicant's PPE must address all the NEI-01-02 parameters to be complete. Indeed, NEI, in correspondence with the NRC concerning the refinement of a PPE worksheet based on the guidance of NEI-01-02, agreed that an applicant should evaluate which parameter values would be necessary for its particular application; that correspondence also noted that the completeness of the industry parameter list would continue to be assessed to identify new or unnecessary parameters. See

Letter from Ronald Simard (NEI) to James Lyons, dated February 7, 2003, ADAMS Accession No. ML030420321.

With respect to the Grand Gulf ESP, the Applicant explained (SSAR Page 1.3-3) that its PPE was derived from a PPE worksheet that was, in turn, based on the guidance of NEI-01-02. The Applicant also explained that the PPE worksheet was refined through work with the NEI ESP Task Force. Because the PPE in the Grand Gulf application is site-specific, it is expected that it would differ from the NEI sample PPE as well as from PPEs developed for other specific sites. For example, some parameters on the NEI list (such as those concerning once-through cooling or cooling ponds) were not relevant to the Grand Gulf ESP application because of the plant design features that the Applicant chose to consider.

In summary, for the Grand Gulf ESP Application, the Staff reviewed the PPE selected by the Applicant and found that the included parameters and parameter values were complete. The Staff agreed that the Applicant's PPE was not unreasonable and was, therefore, acceptable.