Safety Evaluation of Early Site Permit Application in the Matter of System Energy Resources, Inc., a Subsidiary of Entergy Corporation, for the Grand Gulf Early Site Permit Site

Docket No. 52-009

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U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
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ABSTRACT

This draft safety evaluation report (DSER) with open items documents the U.S. Nuclear Regulatory Commission (NRC) staff's technical review of the site safety analysis report and emergency planning information included with the early site permit (ESP) application submitted by System Energy Resources, Inc. (SERI or the applicant), a subsidiary of Entergy Corporation, for the Grand Gulf ESP site. By letter dated October 16, 2003, SERI submitted the application for the Grand Gulf ESP site in accordance with Subpart A, "Early Site Permits," of Title 10, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 52). The Grand Gulf ESP site is in Claiborne County in southwestern Mississippi. The ESP site identified in the application is collocated with the Grand Gulf Nuclear Station, Unit 1, near Port Gibson, Mississippi. In its application, SERI seeks approval of an ESP that could support a future application to construct and operate additional nuclear unit(s) at the ESP site, with total nuclear generating capacity of up to 8,600 megawatts thermal (MWt), with maximum 4,300 MWt per unit.

This DSER presents the results of the staff's review of information SERI submitted in conjunction with the ESP application. In addition, this report presents the status of the staff's review of information submitted by SERI to the NRC through January 25, 2005. The staff has identified open and confirmatory items which the applicant must resolve before the staff can complete its review of the ESP application. Section 1.6 of this report summarizes these items. To resolve these items, the staff requires additional information identified in this report. If the additional information is provided, the staff will provide its conclusions on the review of the Grand Gulf ESP application in a final safety evaluation report.

The staff has also identified certain site-related items that must be addressed at the combined license or construction permit stage, should an applicant desire to construct one or more new nuclear unit(s) on the Grand Gulf ESP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Section 1.7 of the DSER, more appropriately addressed, if necessary, at later stages in the licensing process.

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In accordance with U.S. Nuclear Regulatory Commission Review Standard (RS)-002, "Processing Applications for Early Site Permits," the chapter and section layout of this safety evaluation report is essentially consistent with the format of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (hereafter referred to as the SRP), Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," and the applicant's site safety analysis report. Numerous sections and chapters in the SRP are not within the scope of or addressed in an early site permit (ESP) proceeding. The reader will therefore note "missing" chapter and section numbers in this document. The subjects of chapters and sections in the SRP not discussed herein will be addressed, as appropriate and applicable, in other licensing actions (design certification, construction permit, and/or combined license) for a reactor(s) that might be constructed on the Grand Gulf ESP site.

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EXECUTIVE SUMMARY

Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," of Title 10, of the *Code of Federal Regulations* (10 CFR Part 52) contains requirements for licensing, construction, and operation of new nuclear power plants.[1] These regulations address early site permits (ESPs), design certifications, and combined licenses (COLs). The ESP process (10 CFR Part 52, Subpart A, "Early Site Permits") is intended to address and resolve site-related issues. The design certification process (10 CFR Part 52, Subpart B, "Standard Design Certifications") provides a means for a vendor to obtain U.S. Nuclear Regulatory Commission (NRC) certification of a particular reactor design. Finally, the COL process (10 CFR Part 52, Subpart C, "Combined Licenses") allows an applicant to seek authorization to construct and operate a new nuclear power plant.

This draft safety evaluation report (DSER) describes the results of the NRC staff review of an ESP application submitted by System Energy Resources, Inc. (SERI or the applicant), a subsidiary of Entergy Corporation, for the Grand Gulf ESP site. The staff's review verified, with noted exceptions, the applicant's compliance with the requirements of Subpart A of 10 CFR Part 52. The DSER identifies completion status of the staff's safety review and describes remaining items to be addressed before the staff issues its final safety evaluation report (FSER).

These regulations also contain requirements for an applicant to submit an environmental report pursuant to 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Activities." The NRC reviews the environmental report as part of the agency's responsibilities under the National Environmental Policy Act of 1969, as amended. The NRC presents the results of that review for public comment in a draft environmental impact statement, which is a report separate from this DSER.

By letter dated October 16, 2003, SERI submitted ESP application (ADAMS Accession No. ML032960315)[2] for the Grand Gulf ESP site. The Grand Gulf ESP site is near Port Gibson, Mississippi, approximately 25 miles south of Vicksburg, Mississippi, and is adjacent to the existing nuclear power reactor operated by Entergy Operations, Inc.

In accordance with 10 CFR Part 52, the SERI ESP application includes (1) a description of the site and nearby areas that could affect or be affected by new nuclear unit(s) located at the site,

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[1] Applicants may also choose to seek a construction permit and operating license in accordance with 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," instead of using the 10 CFR Part 52 process.

[2] The Agencywide Documents Access and Management System (ADAMS) is the NRC's information system that provides access to all image and text documents that the NRC has made public since November 1, 1999, as well as bibliographic records (some with abstracts and full text) that the NRC made public before November 1999. Documents available to the public may be accessed via the Internet at http://www.nrc.gov/reading-rm/adams/web-based.html. Documents may also be viewed by visiting the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland. Telephone assistance for using Web-based ADAMS is available at (800) 397-4209 between 8:30 a.m. and 4:15 p.m., eastern standard time, Monday through Friday, except Federal holidays. The staff is also making this DSER available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html.

(2) a safety assessment of the site on which the unit(s) would be located, including an analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site, and (3) the proposed major features of emergency plans. The application describes how the site complies with the requirements of 10 CFR Part 52, Subpart A, and the siting criteria of 10 CFR Part 100, "Reactor Site Criteria."[3]

This report presents the status of the staff's review of the information SERI submitted to the NRC through January 25, 2005. The staff has identified open and confirmatory items that the applicant must resolve before the staff can complete its review of the ESP application. Section 1.6 of this report summarizes these items. To close these items, the staff requires the additional information identified in this report. The staff will provide the conclusions of its review of the Grand Gulf ESP application in the FSER.

In Section 1.7 of the DSER, the staff has identified proposed permit conditions that it will recommend that the Commission impose should an ESP be issued to the applicant. The staff has also identified certain site-related items that will need to be addressed at the COL or construction permit stage, should an applicant desire to construct one or more new nuclear reactors on the Grand Gulf ESP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Section 1.7, more appropriately addressed at these later stages in the licensing process.

Inspections conducted by the NRC have verified, where appropriate, the conclusions in this DSER. The scope of the inspections consisted of selected information in the ESP application and its references. The DSER identifies applicable inspection reports as reference documents.

The NRC's Advisory Committee on Reactor Safeguards (ACRS) will also review the bases for the conclusions in this report. The ACRS will independently review those aspects of the application that concern safety, as well as the DSER, and will report the results of its review to the Commission. The NRC will include the ACRS comments and recommendations, and the staff's responses to them, in the FSER.

As required by 10 CFR 52.21, "Hearing," the review process for the ESP will include a hearing. The NRC published a notice of hearing in the *Federal Register* on December 2, 2003. The Blue Ridge Environmental Defense League; Public Citizen; the National Association for the Advancement of Colored People; Claiborne County, Mississippi; and the Nuclear Information and Resource Service collectively filed a petition for leave to intervene on January 2, 2004 (ADAMS Accession No. ML040510285), and subsequently filed several contentions alleging deficiencies in the SERI application on May 3, 2004 (ADAMS Accession No. ML041320393).

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[3]SERI also submitted information intended to partially address some of the general design criteria (GDC) in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50. Only GDC 2, "Design Bases for Protection Against Natural Phenomena," applies to an ESP application, and it does so only to the extent necessary to determine the safe-shutdown earthquake (SSE) and the seismically induced flood. The staff has explicitly addressed partial compliance with GDC 2, in accordance with 10 CFR 52.17(a)(1) and 10 CFR 50.34(a)(12), only in connection with the applicant's analysis of the SSE and the seismically induced flood. Otherwise, an ESP applicant need not demonstrate compliance with the GDC. The staff has included a statement to this effect in various sections of the DSER that are not related to the SSE or the seismically induced flood. Nonetheless, this report describes the staff's evaluation of information submitted by SERI to address GDC 2.

On August 6, 2004, the Atomic Safety and Licensing Board ruled that no contentions would be admitted in the SERI application (ADAMS Accession No. ML041320393). Therefore, an uncontested hearing will be held upon completion of the staff's safety and environmental reviews.

ABBREVIATIONS

ABWR	advanced boiling-water reactor
ACR	Advanced CANDU Reactor
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ALARA	as low as reasonably achievable
ALI	annual limits on intake
ALWR	advanced light-water reactor
ANS	alert and notification system
ANS	American Nuclear Society
ANSI	American National Standards Institute
ANSS	Advanced National Seismic System
APE	annual probability of exceedance
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testings
ASTM	American Society for Testing and Materials
ASU	Alcorn State University
BE	best estimate
BRH	Bureau of Radiological Health
BWR	boiling-water reactor
CAR	corrective action report
CDE	committed dose equivalent
CEUS	central and eastern United States
CFR	*Code of Federal Regulations*
CH	fat clay
CL	clay layer
COL	combined license
CP	construction permit
CPT	cone penetrometer test
CSP	corporate standard procedure
CU	consolidated undrained
DAC	derived air concentration
DBA	design-basis accident
DCD	design control document
DEIS	draft environmental impact statement
DHH	Department of Health and Hospitals
DOE	Department of Energy
DOT	Department of Transportation
DPF	design project flood
DRG	digital raster graph
DSER	draft safety evaluation report
E	existing
EAB	exclusion area boundary
EAL	emergency action level

EAS	emergency alert system
ECFS	East Coast fault system
ECG	Exelon Generation Company
EDS	engineering design spectrum
EIS	environmental impact statement
EMI	Emergency Management Institute
EN	existing and near future
END	existing, near future, and distant future
ENS	emergency notification system
EOC	emergency operations center
EOF	emergency operations facility
EPA	Environmental Protection Agency
EPIP	emergency plan implementing procedure
EPZ	emergency planning zone
EPRI	Electric Power Research Institute
ER	environmental report
ERO	emergency response organization
ERDS	Emergency Response Data System
ESBWR	economic and simple boiling water reactor
ESE	east-southeast
ESP	early site permit
EST	earth science team
ETE	evacuation time estimate
ETSZ	Eastern Tennessee Seismic Zone
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FRMAC	Federal Radiological Monitoring and Assessment Center
FRP	Federal Response Plan
FRERP	Federal Radiological Emergency Response Plan
FS	factor of safety
FSER	final safety evaluation report
GDC	general design criterion/criteria
GGNS	Grand Gulf Nuclear Station
gpm	gallons per minute
GSA	Geological Society of America
GT-MHR	gas turbine modular helium reactor
HEAR	hospital emergency and administrative radio
HMR	hydrometeorological report
Hz	hertz
INPO	Institute of Nuclear Power Operations
IRAP	Interagency Radiological Assistance Plan
ISFSI	independent spent fuel storage installation
JPIC	Joint Public Information Center
KI	potassium iodide
kPa	kiloPascals
LB	lower bound
LDEQ	Louisiana Department of Environmental Quality

LEOP	Louisiana Emergency Operations Plan
LLNL	Lawrence Livermore National Laboratory
LOA	letter of agreement
LOCA	loss-of-coolant accident
LPRRP	Louisiana Peacetime Radiological Response Plan
LPZ	low-population zone
LSU	Louisiana State University
LWR	light-water reactor
M&TE	measuring and test equipment
Ma	million years before present
MEMA	Mississippi Emergency Management Agency
MIDAS	meteorological information and dose assessment system
MREPP	Mississippi Radiological Emergency Preparedness Plan
MSDH/DRH	Mississippi State Department of Health/Division of Radiological Health
MSL	mean sea level
Mw	moment magnitude
MWe	megawatt electric
MWt	megawatt thermal
NAD	North American Datum
NCDC	National Climatic Data Center
NE	northeast
NEI	Nuclear Energy Institute
NEP	nuclear emergency preparedness
NIST	National Institute of Standards and Technology
NMSZ	New Madrid Seismic Zone
NNE	north-northeast
NOAA	National Oceanic and Atmospheric Administration
NPSEPT	nuclear power station emergency preparedness training
NRC	U.S. Nuclear Regulatory Commission
NSSL	National Severe Storms Laboratory
NSSS	nuclear steam supply system
NUPIC	Nuclear Procurement Issues Committee
NWS	National Weather Service
OBE	operating-base earthquake
OCA	owner-controlled area
OL	operating license
OSC	operational support center
OW	observation well
PAA	protection action area
PAG	protective action guide
PAR	protective action recommendation
PAZ	protective action zone
PDS	plant data system
PGA	peak ground acceleration
PGCCCD	Port Gibson/Claiborne County Civil Defense
PGCCREPP	Port Gibson/Claiborne County Radiological Emergency Preparedness Plan
PIO	public information officer

PMBR	Pebble Bed Modular Reactor
PMF	probable maximum flood
PMH	probable maximum hurricane
PMP	probable maximum precipitation
PNNL	Pacific Northwest National Laboratory
PPBA	proposed powerblock area
PPE	plant parameter envelope
PSHA	probabilistic seismic hazard analysis
PWR	pressurized-water reactor
QA	quality assurance
QAPPD	quality assurance project planning document
QAPM	quality assurance program manual
RAA	remote assembly area
RACES	Radio Amateur Civil Emergency Service
RAI	request for additional information
RAP	radiological assistance program
RC	resonant column
RERP	radiological emergency response plan
RERT	radiological emergency response team
RG	regulatory guide
ROB	River Operations Branch
RQD	rock-quality designation
RS	review standard
S	south
Sa	spectral acceleration
SC	clayey sand
SCS	Soil Conservation Service
SE	southeast
SEI	Structural Engineering Institute
SEOC	State emergency operations center
SER	safety evaluation report
SERI	System Energy Resources, Inc.
SF	scale factor
SMEDA	South Mississippi Electric Power Association
SMRAP	Southern Mutual Radiation Assistance Plan
SOP	standard operating procedure
SP	poorly grade sand
SPF	standard project flood
SPT	standard penetration test
SSAR	site safety analysis report
SSE	safe-shutdown earthquake
SRCC	Southern Regional Climate Center
SRP	Standard Review Plan
SRSZ	Saline River Source Zone
SSC	structure, system, and component
SWR	service water reservoir
TEDE	total effective dose equivalent

TLD	thermoluminescent dosimeter
TS	torsional shear
TSC	technical support center
UB	upper bound
UFSAR	updated final safety analysis report
UHF	ultrahigh frequency
UHS	ultimate heat sink
UHS	uniform hazard spectra
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	uniform soil classification
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
UT	University of Texas
UTM	universal transverse mercator
WHTF	waste heat treatment facility
WLA	William Lettis & Associates
YMCA	Young Men's Christian Association

1. INTRODUCTION AND GENERAL DESCRIPTION

1.1 Introduction

System Energy Resources, Inc. (SERI), filed an application with the U.S. Nuclear Regulatory Commission (NRC), docketed on October 16, 2003, for an early site permit (ESP) for a site designated by the applicant as the Grand Gulf ESP site. The proposed site is located near Port Gibson, Mississippi, approximately 25 miles south of Vicksburg, Mississippi.

The staff has completed its review, to the extent possible at this time, in the areas of seismology, geology, meteorology, and hydrology, as well as in the area of hazards to a nuclear power plant that could result from man-made facilities and activities on or in the vicinity of the site. The staff also assessed the risks of potential accidents that could occur as a result of the operation of a nuclear power plant(s) at the site and evaluated whether the site would support adequate physical security measures for a nuclear power plant(s). The staff evaluated whether the applicant's quality assurance measures were equivalent in substance to the measures discussed in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the *Code of Federal Regulations* (10 CFR Part 50). The NRC has found that such measures provide reasonable assurance that any information derived from ESP activities that could be used in the design and/or construction of structures, systems, and components (SSCs) important to safety would support satisfactory performance of such SSCs once in service. The staff also evaluated the adequacy of the applicant's program for compliance with 10 CFR Part 21, "Reporting of Defects and Noncompliance." Finally, the staff reviewed the proposed major features of the emergency plan that SERI would implement if new nuclear unit(s) were eventually to be constructed at the ESP site.

The SERI ESP application includes a description and a safety assessment of the site, as required by 10 CFR 52.17, "Contents of Applications." The public may inspect copies of this document via the Agencywide Documents Access and Management System (ADAMS)[1] using ADAMS Accession No. ML042590081. The documents are also available for public inspection at the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, and at the Harriette Person Memorial Library in Port Gibson, Mississippi. The staff is also making this draft safety evaluation report (DSER) available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html. SERI has committed to revise its application to address the NRC staff requests for additional information (RAIs), and updated versions of the ESP application will also be available at these same locations. The NRC will verify that any future revision of the SERI ESP application is

[1]The Agencywide Documents Access and Management System (ADAMS) is the NRC's information system that provides access to all image and text documents that the NRC has made public since November 1, 1999, as well as bibliographic records (some with abstracts and full text) that the NRC made public before November 1999. Documents available to the public may be accessed via the Internet at http://www.nrc.gov/reading-rm/adams/web-based.html. Documents may also be viewed by visiting the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland. Telephone assistance for using Web-based ADAMS is available at (800) 397-4209 between 8:30 a.m. and 4:15 p.m., eastern standard time, Monday through Friday, except Federal holidays. The staff is also making this DSER available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html.

consistent with information provided in the applicant's RAI responses. This verification is identified as **Confirmatory Item 1.1-1**.

This DSER summarizes the results of the NRC staff's technical evaluation of the suitability of the proposed Grand Gulf ESP site for new nuclear unit(s) falling within the plant parameter envelope (PPE) that SERI specified in its application. This report delineates the scope of the technical matters the staff considered in evaluating the suitability of the site. The NRC Review Standard (RS)-002, "Processing Applications for Early Site Permits," provides additional details on the scope and bases of the NRC staff's review of the radiological safety and emergency planning aspects of a proposed nuclear power plant site. RS-002 contains regulatory guidance based on NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (hereafter referred to as the SRP). The SRP reflects the many years of experience the NRC staff has had in establishing and promulgating guidance to enhance the safety of nuclear facilities, as well as in evaluating safety assessments.

The applicant also filed an environmental report for the Grand Gulf ESP site in which it evaluated the environmental impacts of constructing and operating new nuclear unit(s) at the Grand Gulf ESP site. The staff will discuss the results of its evaluation of the environmental report for the Grand Gulf ESP site in a draft environmental impact statement (DEIS). The applicant stated that it has no plans to perform activities at the Grand Gulf site under 10 CFR 50.10(e)(1), after receiving an ESP; therefore, it did not provide a site redress plan.

Appendix A to this report details a chronology of the principal actions and correspondence related to the staff's review of the ESP application for the Grand Gulf ESP site. Appendix B contains the references used in this DSER.

1.2 General Site Description

The proposed ESP site is a parcel of land on the Grand Gulf Nuclear Station (GGNS) site in Claiborne County in southwestern Mississippi. The site is on the east side of the Mississippi River about 25 miles south of Vicksburg, Mississippi, 6 miles northwest of Port Gibson, Mississippi, and 37 miles north-northeast of Natchez, Mississippi. The Grand Gulf Military Park borders a portion of the north side of the property, and the community of Grand Gulf is approximately 1.5 miles to the north.

The applicant stated that the GGNS site encompasses approximately 2100 acres of property. The site and its environs consist primarily of woodlands and farms. Within this area are two lakes, Gin Lake and Hamilton Lake. These lakes were once the channel of the Mississippi River and average about 8 to 10 feet in depth.

SERI, owner of the proposed site, is a wholly owned subsidiary of the Entergy Corporation. Other existing nuclear facilities licensed by the NRC are located on the GGNS site, including GGNS Unit 1 (Docket No. 50-416, NRC Facility Operating License No. NPF-29) and the Grand Gulf Independent Spent Fuel Storage Installation (ISFSI) (NRC Docket No. 72-50).

The ESP site, adjacent to the existing GGNS Unit 1, is a single-unit nuclear generating plant capable of producing 3898 megawatt thermal (approximately 1353 megawatt electric gross).

This boiling-water reactor, designed by General Electric, has been producing electricity since 1985.

The nearest communities include Port Gibson, Mississippi, approximately 6 miles southeast of the site; Newellton, Louisiana, approximately 12 miles west of the site; and St. Joseph, Louisiana, approximately 13 miles west-southwest of the site.

The transportation infrastructure within the region includes the Mississippi River, U.S. Interstate Highway 20 (a portion of which lies approximately 28 miles north of the GGNS site), and U.S. Interstate Highway 55 (a portion of which lies approximately 40 miles east of the GGNS site). U.S. Highway 65 runs north to south in Louisiana and lies approximately 9 miles to the west of the site, connecting to U.S. Highway 84 approximately 27 miles to the southeast of the site.

Recreational facilities near the site include the Grand Gulf Military Park, which borders a portion of the north side of the property, Lake Bruin State Park, Warner-Tully YMCA Camp, and several hunting and fishing clubs.

No military installations are located near the GGNS site area, and no missile sites are located in either Mississippi or Louisiana. The nearest military facility was England Air Force Base in Alexandria, Louisiana, approximately 100 miles to the southwest; however, it officially closed in 1993.

The nearest natural gas pipeline is 4.75 miles east of the site. No mining operations occur within the vicinity of the GGNS site.

No commercial airport facilities are located within 10 miles of the GGNS site. The nearest commercial airport is located in Jackson, Mississippi, approximately 65 miles northeast of the site. Five general/public aviation airports are located within the vicinity of the site and are only used for small planes.

1.3 Plant Parameter Envelope

The regulations at 10 CFR Part 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants,” and 10 CFR Part 100, “Reactor Site Criteria,” that apply to an ESP do not require that an ESP applicant provide specific design information. However, some design information is required to address 10 CFR 52.17(a)(1), which calls for “an analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site under the radiological consequence evaluation factors identified in § 50.34(a)(1) of this chapter.”

In Section 1.3 of the ESP site safety analysis report (SSAR), the applicant provided a list of postulated design parameters, referred to as the “plant parameter envelope (PPE).” The applicant stated that the PPE is a set of design parameters that are expected to bound the characteristics of new nuclear unit(s) that might later be constructed at the site.

The applicant stated that it based the listing of plant parameters necessary to define the plant-site interface on previous industry and Department of Energy-sponsored work performed in the

early 1990s as part of the ESP Demonstration Program, as well as current reactor vendor design input data. As a result of earlier and current efforts, the applicant identified appropriate design parameters to include in the PPE through a systematic review of regulatory criteria and guidance, ESP application content requirements, and experience with previous site suitability studies. The plant parameters characterize (1) the functional or operational needs of the plant from the site's natural or environmental resources, (2) the plant's impact on the site and surrounding environs, and (3) the site-imposed requirements on the plant. The PPE values are generally based on certified design information and the best available information for as yet uncertified designs. Some of the values have been modified to include margin.

SERI developed set of plant parameter values by considering the values provided by various reactor vendors and by applying appropriate conservatism, when required, to characterize the surrogate facility. As applicable, the most limiting (maximum or minimum) bounding value is selected. The complete set of plant parameter values describes, or envelops, the site-facility interface.

Tables 1.3-1 through 1.3-3 of the applicant's SSAR present the listing of parameters employed, the PPE values selected, and the site characteristic values used to assess the safety and environmental impact of constructing and operating the Grand Gulf ESP facility.

The applicant has stated that, through its PPE, sufficient design information to allow it to perform the evaluation required by 10 CFR 52.17(a)(1) to determine the adequacy of the proposed exclusion area and low-population zone (LPZ) for the site. Section 3.3 of the SSAR reports the results of this evaluation. In the evaluation, the applicant used design information limited to the rate of release of radioactivity to the environment as a result of a design-basis accident for hypothetical reactors similar to the two representative reactor types that vendors have offered for construction in the United States.

In addition to the information supporting the dose consequence evaluation, the applicant provided other design information in its PPE. Because the applicant is not requesting that an ESP be issued referencing a particular reactor design, the staff's review criterion for the PPE is that the values should be reasonable for a reactor that might be constructed on the ESP site. The applicant's PPE is based on various reactor designs that are either certified by the NRC, are in the certification process, or may be submitted for certification in the future. The PPE references the following designs:

- Advanced Canada Deuterium Uranium (CANDU) Reactor (ACR-700) (Atomic Energy of Canada, Ltd.)
- Advanced Boiling-Water Reactor (General Electric)
- AP1000 (Westinghouse Electric Company)
- Economic and Simplified Boiling-Water Reactor (General Electric)
- Gas Turbine Modular Helium Reactor (General Atomics)

- International Reactor Innovative and Secure (IRIS) Project (consortium led by Westinghouse)

- Pebble Bed Modular Reactor (PBMR (Pty) Ltd.)

The staff reviewed the applicant's PPE values and found them to be reasonable, as discussed in the individual DSER sections. The staff has identified individual PPE values and site characteristics that will be included in an ESP, should the NRC issue one for the Grand Gulf ESP site. In such a case, any entity that wishes to reference that ESP in a combined license (COL) or construction permit (CP) application would need to demonstrate that the chosen design falls within the PPE values and site characteristics specified in the ESP. Otherwise, the COL or CP applicant would need to demonstrate that the new design, in conjunction with the site characteristics, complies with the applicable NRC regulations.

1.4 Identification of Agents and Contractors

SERI is the applicant for the Grand Gulf ESP application; SERI authorized Entergy Nuclear Potomac Company (ENPC) (another Entergy subsidiary) to prepare the application. Furthermore, ENPC was the only participant in the review of the suitability of the Grand Gulf ESP site for a nuclear power plant. Enercon Services, Inc., under contract to ENPC, served as primary contractor for development of the ESP application, supplying personnel, systems, and project management.

Several subcontractors also assisted in developing the ESP application. William Lettis and Associates, Inc., performed geotechnical field investigations, geologic mapping and characterization of seismic sources, and sensitivity analyses. Black Diamond Consultants, Inc., provided emergency planning evaluations.

1.5 Summary of Principal Review Matters

This DSER summarizes the results of the staff's technical evaluation of the Grand Gulf ESP site. The staff's evaluation included a review of the information and data the applicant submitted, with emphasis on the following matters:

- population density and land use characteristics of the site environs and the physical characteristics of the site, including seismology, meteorology, geology, and hydrology, to evaluate whether these characteristics were adequately described and were given appropriate consideration to determine whether the site characteristics are in accordance with the Commission's siting criteria (Subpart B, "Evaluation Factors for Stationary Power Reactor Site Applications on or after January 10, 1997," of 10 CFR Part 100)

- potential hazards to new nuclear unit(s) that might be constructed on the ESP site posed by man-made facilities and activities (e.g., mishaps involving storage of hazardous materials (toxic chemicals, explosives), transportation accidents (aircraft, marine traffic, railways, pipelines), and the existing nuclear power plant)

- potential capability of the site to support the construction and operation of new nuclear unit(s) with design parameters falling within those specified in the applicant's PPE under the requirements of 10 CFR Parts 52 and 100

- suitability of the site for developing adequate physical security plans and measures for new nuclear unit(s)

- proposed major features for an emergency plan to be developed, should the applicant decide to seek a license to construct and operate new nuclear unit(s) on the ESP site; any significant impediments to the development of emergency plans for the Grand Gulf ESP site; and a description of contacts and arrangements made with Federal, State, and government agencies with emergency planning responsibilities

- quality assurance measures applied to the information submitted in support of the applicant's ESP application and safety assessment

- the acceptability of the applicant's proposed exclusion area and LPZ under the dose consequence evaluation factors of 10 CFR 50.34(a)(1)

During its review, the staff held several meetings with representatives of the applicant and the applicant's contractors and consultants to discuss various technical matters related to the staff's review of the Grand Gulf ESP site (see Appendix A to this report). The staff also visited the site to assist in its evaluation of safety matters.

1.6 Summary of Open and Confirmatory Items

As discussed in this DSER, the staff is requesting additional information from the applicant regarding certain matters. The individual sections of this report refer to these issues as open items. The staff assigns each of these issues an identifying number for tracking purposes. Table 1.6-1 lists each open item, the DSER section in which it appears, and the subject matter to which it is related. Completion of the staff's final safety evaluation report (FSER) according to the current schedule will depend on the applicant's timely submission of information sufficient to resolve each open item and allow the staff to review that information before issuance of the FSER.

Table 1.6-1 Open Items

Open Item No.	DSER Section	Subject
2.1-1	2.1.2.3	Demonstrate that the applicant has control over the exclusion area or has a right to obtain such control.
2.1-2	2.1.3.3	Include weighted transient population data in Tables 2.1-1 and 2.1-2 of the SSAR.
2.3-1	2.3.1.3	Provide acceptable 100-year return period maximum and minimum dry-bulb temperatures.
2.3-2	2.3.1.3	Identify an additional ultimate heat sink (UHS) meteorological site characteristic for use in evaluating the potential for water to freeze in the UHS water storage facility.
2.3-3	2.3.1.3	Identify a 3-second gust wind speed that represents a 100-year return period for the ESP site.
2.3-4	2.3.5.3	Identify x/Q and D/Q values for the nearest milk cow and meat cow.
2.4-1	2.4.1	Provide corrected UTM coordinates of the center of the proposed powerblock and/or revise Figure 2.1-1 in the SSAR to show the correct location and coordinates.
2.4-2	2.4.1	Provide information on the elevation (depth) of the zone that could be disturbed by the construction of the new facility, such that the local subsurface environment and its alignment with the existing hydrogeological environment could be altered.
2.4-3	2.4.1	Provide more details regarding dewatering wells to allow the staff to determine whether ground surface subsidence could affect safety-related structures and piping. Provide information related to the location of dewatering wells in relation to safety-related structures and associated monitoring of the ground water table.
2.4-4	2.4.1	Provide more details regarding the floodwater level estimation, including data and methods used to arrive at the floodwater elevation of 133.25 feet MSL.
2.4-5	2.4.2	Revise and present estimates of the local intense precipitation as shown in Table 2.4-7 of the SSAR using the guidelines of HMR 52.

Open Item No.	DSER Section	Subject
2.4-6	2.4.13	Provide further description of the rationale for considering Sr-90 and Cs-137 in the radionuclide transport analysis.
2.4-7	2.4.13	Factors, such as soil, sediment, and rock characteristics; adsorption and retention coefficients; ground water velocity; and distances to the nearest body of surface water are important to hydrological radionuclide transport. Provide these site characteristics from onsite measurements.
2.5-1	2.5.2	Provide justification for not updating the background seismic source for the ESP site.
2.5-2	2.5.2	Provide and evaluate the criteria or weights used for ranking of model clusters and the judgements involved in balancing data consistency and adherence to seismological principles in the EPRI 2003 ground motion evaluation. Explain how recordings from a single earthquake can provide well-resolved values of both crustal quality factor (Q) and site kappa, also explain why the Q value of 317 at 1 Hz is much lower than values found in other studies of eastern North American earthquakes, and why other studies find less frequency dependence of Q in the eastern North American than in the western North American.
2.5-3	2.5.2	Provide an explanation why the magnitude and distance bin corresponding to the SRSZ makes no contribution to the hazard deaggregation.
2.5-4	2.5.2 and 2.5.4	Provide justification on applying the generic shear wave velocity profile derived from Memphis area to the ESP site and on its applying kappa value derived from ground motion observation on the Mississippi embayment in the sensitivity test.
13.3-1	Provide responses to the following issues related to State and local emergency plans:	
a.	13.3.3.7	Describe the communications arrangements with fixed and mobile medical support for the State of Mississippi and with mobile medical support for Claiborne County.

Open Item No.	DSER Section	Subject
b.	13.3.3.8	Describe the dissemination of information regarding the special needs of the handicapped to the general public in the State of Louisiana on a periodic basis.
c.	13.3.3.11	Describe the means for the use of radioprotective drugs for emergency workers and institutionalized persons within the plume exposure pathway EPZ in the States of Louisiana and Mississippi whose immediate evacuation may be infeasible or very difficult.
d.	13.3.3.12	Describe the State of Mississippi's guidance related to bioassay or whole body counting for determining offsite emergency worker doses from the uptake of radioactive material (e.g., ingestion)
e.	13.3.3.13	Clarify the apparent inconsistencies between the LPRRP and Enclosure I to Attachment 2 to LPRRP Supplement II regarding the description of contacts and arrangements for local and backup hospital services.
f.	13.3.3.13	Describe the special radiological capabilities for the hospitals listed in Tab 2 of LPRRP Chapter 10.
g.	13.3.3.11	Provide information regarding the availability and capacity of school buses or other transportation methods, the availability of drivers, and the process for mobilizing transportation for students, residents, transients, and special needs populations in Claiborne County and Tensas Parish during an evacuation (e.g., evacuations may require a single trip or they may require return trips).
h.	13.3.3.11	Provide a map(s) illustrating evacuation/shelter areas in the State of Mississippi for the MREPP Annex O.
i.	13.3.3.11	Information on shelter capacities is not contained in, and therefore, not evaluated by FEMA under the LPRRP. Provide sheltering capacities for relocation centers in the State of Louisiana or documentation of evaluation performed to determine whether adequate capacity exists.
13.3-2	13.3.3.8	Describe in Part 4 the applicant's responsibility for making information available to offsite authorities for distribution consistent with MREPP Annex J.

Open Item No.	DSER Section	Subject
13.3-3	13.3.3.9	Describe the adequacy of the TSC, OSC, and EOF and related equipment used to support emergency response activities, to address, with specificity, such facility and equipment features as location, size, structure, habitability, communications, staffing and training, radiation monitoring, instrumentation, data system equipment, power supplies, technical data and data systems, and record availability and management.
13.3-4	13.3.3.11	Address whether discussions on results of the 2003 ETE study were held with officials from the States of Mississippi and Louisiana involved in implementing traffic management plans, according to Appendix 4 to NUREG-0654/FEMA-REP-1 and NUREG/CR-4831, or provide confirmation that State reviews were not required based on discussions with appropriate officials.

Table 1.6-2 lists confirmatory items and the subject matter to which they are related. Completion of the staff's FSER will depend on the applicant's timely completion of planned actions to allow the staff to review and, if appropriate, close the confirmatory item before issuance of the FSER.

Table 1.6-2 Confirmatory Items

Confirmatory Item No.	DSER Section	Subject
1.1-1	1.1	Verification that any ESP application revision is consistent with RAI responses.
17.3-1	17.3	Verification of information obtained from the Internet.

1.7 Summary of Permit Conditions and COL Action Items

The staff has identified certain permit conditions that it will recommend the Commission impose should the NRC issue an ESP to the applicant. Table 1.7-1 summarizes these conditions.

Table 1.7-1 Permit Conditions

Permit Condition No.	DSER Section	Description
2.4-1	2.4.1	Design the plant grade such that flooding caused by local intense precipitation will be discharged to Streams A and B without reliance on any active drainage systems that may become blocked during the local intense precipitation event.
2.4-2	2.4.1	Demonstrate that there is sufficient separation between the new intake and the combined effluent outfall so that the effluent recirculating back to the new intake will not adversely affect it.
2.4-3	2.4.1	Demonstrate that the service and makeup water withdrawal does not exceed 85,000 gpm.
2.4-4	2.4.2	Demonstrate that the ESP plant grade is safe from the flooding effects of maximum water surface elevation during local intense precipitation without relying on any active surface drainage systems that may be blocked during this event.
2.4-5	2.4.8	Demonstrate the availability of a 30-day cooling water supply for the UHS, accounting for any losses including, but not limited to, those caused by evaporation, seepage, and icing, as well as a margin of safety.
2.4-6	2.4.8	Demonstrate that the UHS is not used frequently for non emergencies.
2.4-7	2.4.12	Demonstrate that the ground water well system design is capable of withdrawing a large flow of 3570 gpm to provide for the ESP facility or facilities under design low-water conditions.
2.4-8	2.4.12	Provide location and extent of perched aquifers, including their areal and vertical extent, and demonstrate that no potential exists for radionuclide contamination to the nearest ground water user.

Permit Condition No.	DSER Section	Description
2.5-1	2.5.1	Perform geologic mapping of future excavations for safety-related structures, evaluate any unexpected geologic features that are encountered, and notify the NRC for the purpose of examination and evaluation when any excavations for safety-related structures are open.
2.5-2	2.5.4	To place the new plant foundations on the soil with a minimum shear wave velocity of 1,000 ft/sec.

The staff also identified certain site-related items that will need to be addressed at the COL or CP stage, should a COL or CP applicant desire to construct one or more new nuclear reactors on the Grand Gulf ESP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Table 1.7-2, more appropriately addressed at these later stages in the licensing process.

Table 1.7-2 Site-Related COL Action Items

Action Item No.	DSER Section	Subject To Be Addressed	Reason for Deferral
2.1-1	2.1.2.3	Make arrangements with the appropriate local, State, Federal, or other public agencies to provide for control of the property that is within the exclusion area. These public agencies, together with the ESP holder, will need authority over the land and water sufficient to allow for the exclusion and ready removal, in an emergency, of any persons present on them.	Such arrangements are not required at ESP stage.
2.2-1	2.2.3.3	Evaluate hazards posed on or in the vicinity of the ESP site.	No hazards are present, but zoning could allow them during ESP term.
2.3-1	2.3.3.3	Evaluate interaction between the existing meteorological tower and the proposed facility's cooling towers.	Design and specific location of cooling tower units are not known at ESP stage.
2.3-2	2.3.4.1	Evaluate dispersion of airborne radioactive materials to the control room.	Control room location and design features are not known at ESP stage.

Action Item No.	DSER Section	Subject To Be Addressed	Reason for Deferral
2.3-3	2.3.5.3	Confirm specific release point characteristics and locations of potential receptors for routine release dose computations.	Exact release points and receptor locations are not known at ESP stage.
2.4-1	2.4.11	Determine restrictions on operation from changes in frequency of low-water conditions in the lake.	Future uses, and therefore low-level frequency, are not known at ESP stage.
2.5-1	2.5.4	If the new Category I foundations will be lower than those at the existing Grand Gulf Nuclear Station, discuss and evaluate the impact on the anticipated construction procedures.	Extra unit locations not known at ESP
2.5-2	2.5.4	Conduct detailed studies of the fill material and the required treatment during the stage COL stage.	Future uses, and therefore low-level frequency, are not known at ESP stage.
2.5-3	2.5.4	Perform additional borings, laboratory tests, and geophysical survey during the COL stage.	Location and depth of borings not known at ESP stage
2.5-4	2.5.4	Perform geotechnical investigations to verify soil properties at the zone with increased P-wave velocity.	Geotechnical data not available at the ESP stage.
2.5-5	2.5.4	Correlate plot plans and the profiles of each seismic category I structure with subsurface profile and material properties to ascertain the sufficiency of selected borings to represent the spectrum of soil variations under each structure.	Extra unit locations unknown at ESP stage.
2.5-6	2.5.4	Discuss potential evacuation procedures that may be used. Also, address the impact of the adjacent bluff on temporary support conditions and how this may impact standoff distance in the ESP area.	Extra unit locations unknown at ESP stage.
2.5-7	2.5.4	Use boring programs to evaluate potential for karst formation.	Extra unit locations unknown at ESP stage.

Action Item No.	DSER Section	Subject To Be Addressed	Reason for Deferral
2.5-8	2.5.4	Develop design criteria associated with structural design such as potential wall rotations, facility sliding and overturning.	Extra unit locations unknown at ESP stage.
2.5-9	2.5.5	Present qualitative assessment of slope escarpment stability with the consideration of potential impact of difference in elevations on SSI evaluations of safety -related facilities.	Extra unit locations unknown at ESP stage.
2.5-10	2.5.6	Evaluate the impact of the potential flooding of the Mississippi River to the bluff.	Extra unit locations unknown at ESP stage.
3.2-1	3.2.4	Verify that calculated radiological doses to members of the public from radioactive gaseous and liquid effluents from ESP facility are bounded by the radiological doses included in the SSAR for the ESP application and reviewed by the NRC staff.	Specific details of how an ESP facility will control, monitor, and maintain radioactive gaseous and liquid effluents are not known at ESP stage.