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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ABSTRACT

This safety evaluation report (SER) documents the U.S. Nuclear Regulatory Commission 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 8600 megawatts thermal (MWt), with a maximum 4300 MWt per unit.

This SER presents the results of the staff's review of information submitted in conjunction with the ESP application. The staff has identified, in Appendix A to this SER, certain site-related items that will need to be addressed at the combined license 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 of this SER, more appropriately addressed at later stages in the licensing process. Appendix A to this SER also identifies the proposed permit conditions that the staff recommends the Commission impose, should an ESP be issued to the applicant.

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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

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) contains requirements for the 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 (Subpart A, "Early Site Permits," of 10 CFR Part 52) is intended to address and resolve site-related issues. The design certification process (Subpart B, "Standard Design Certifications," of 10 CFR Part 52) provides a means for a vendor to obtain U.S. Nuclear Regulatory Commission (NRC) certification of a particular reactor design. Finally, the COL process (Subpart C, "Combined Licenses," of 10 CFR Part 52) allows an applicant to seek authorization to construct and operate a new nuclear power plant. A COL may reference an ESP, a certified design, both, or neither. It is incumbent on a COL applicant to resolve issues related to licensing that were not resolved as part of an ESP or design certification proceeding before the NRC can issue a COL.

This safety evaluation report (SER) 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 the applicant's compliance with the requirements of Subpart A of 10 CFR Part 52. This SER serves to identify the matters resolved in the safety review and to identify remaining items to be addressed by a future COL applicant referencing this ESP.

As required by 10 CFR Part 52, an applicant must 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 its 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 SER.

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 a new nuclear unit(s) located at the

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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 SER available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html.

site, (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 Subpart A of 10 CFR Part 52 and the siting criteria of 10 CFR Part 100, "Reactor Site Criteria."[3]

This SER presents the conclusions of the staff's review of information the applicant submitted to the NRC in support of the ESP application. Additionally, the staff has reviewed the information SERI provided to resolve the open and confirmatory items identified in the draft safety evaluation report (DSER) for the Grand Gulf ESP, issued on April 7, 2005. In Section 1.6 of this SER, the staff provides a brief summary of the process used to resolve these items; specific details on the resolution for each open item is presented in the corresponding section of this report.

The staff has identified, in Appendix A to this SER, the proposed permit conditions that it will recommend the Commission impose, should an ESP be issued to the applicant. Appendix A also includes a list of COL action items or certain site-related items that will need to be addressed should this ESP be referenced as a part of a COL or construction permit application. The staff determined that these deferred items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Section 1.7 of this SER, more appropriately addressed at later stages in the licensing process. In addition, Appendix A lists the site characteristics and the bounding parameters identified by the staff for the ESP site.

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

The NRC's Advisory Committee on Reactor Safeguards (ACRS) also reviewed the bases for the conclusions in this report. The ACRS independently reviewed those aspects of the application that concern safety, as well as the safety evaluation report, and provided the results of its review to the Commission in an interim report dated June 14, 2005, and in a final report dated December 23, 2005. This SER incorporates the ACRS comments and recommendations, as appropriate. Appendix E includes a copy of the report by the ACRS on the final safety evaluation, as required by 10 CFR 52.23, "Referral to the ACRS," and a copy of the two memoranda the staff sent the ACRS responding to their comments and recommendations.

[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 those sections of the SER that do not relate 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.

ABBREVIATIONS

ABWR	advanced boiling-water reactor
acre-ft	acre-foot/feet
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 limit 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
ANST	American Society for Nondestructive Testing
AP1000	Westinghouse Advanced Plant 1000
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*
cfs	cubic feet per second
CH	fat clay
CL	clay layer
Co	cobalt
COL	combined license
COV	coefficient of variation
CP	construction permit
CPT	cone penetrometer test
Cs	cesium
CSP	corporate standard procedure
CU	consolidated undrained
DAC	derived air concentration
DBA	design-basis accident
DBE	design-basis event
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
EAB	exclusion area boundary
EAL	emergency action level
EAS	emergency alert system
ECFS	East Coast fault system
EGC	Exelon Generation Company
EDS	engineering design spectrum
EIS	environmental impact statement
EMI	Emergency Management Institute
ENPC	Entergy Nuclear Potomac Company
ENS	emergency notification system
EOC	emergency operations center
EOF	emergency operations facility
EPA	Environmental Protection Agency
EPIP	emergency plan implementing procedure
EPRI	Electric Power Research Institute
EPRI-TR	Electric Power Research Institute Technical Report
EPZ	emergency planning zone
ER	environmental report
ERDS	Emergency Response Data System
ERO	emergency response organization
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
Eustis	Eustis Engineering Company, Inc.
FAA	Federal Aviation Administration
Fe	iron
FEMA	Federal Emergency Management Agency
fps	feet/foot per second
FRP	Federal Response Plan
FRERP	Federal Radiological Emergency Response Plan
FS	factor of safety
FSER	final safety evaluation report
ft^2	square feet
ft/mi	foot/feet per mile
ft/yr	foot/feet per year
GDC	general design criterion/criteria
GGNS	Grand Gulf Nuclear Station
gpd	gallons per day
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
in./h	inch(es) per hour
INPO	Institute of Nuclear Power Operations
IRIS	international reactor innovative and secure (project)
ISFSI	independent spent fuel storage installation
K_d	distribution coefficients
kg/m^3	kilogram(s) per cubic meter
KI	potassium iodide
km^2	square-kilometers
k_o	stress ratio parameter
km/s	kilometer(s) per second
kPa	kiloPascals
kW/m^2	kilowatt(s) per square meter
LB	lower bound
lbf/ft^2	pounds per square foot
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
LOEP	Louisiana Office of Emergency Preparedness
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
MAE	Mid American Earthquake
m_b	body-wave magnitude
MDOT	Mississippi Department of Transportation
MEERL	mobile environmental emergency response lab
MEMA	Mississippi Emergency Management Agency
MIDAS	meteorological information and dose assessment system
mi/hr	mile(s) per hour
mm/yr	millimeter(s) per year
mph	miles per hour
mrem/hr	millirem per hour
mrem/yr	millirem per year
MREPP	Mississippi Radiological Emergency Preparedness Plan
m/s	meter(s) per second
MSDH/DRH	Mississippi State Department of Health/Division of Radiological Health
MSL	mean sea level
mSv/yr	millisievert per year
Mw	moment magnitude
MWe	megawatt electric
MWt	megawatt thermal

NAD	North American Datum
NACOM	national communication system
NAWAS	national warning system
NCDC	National Climatic Data Center
NE	northeast
NEI	Nuclear Energy Institute
NEP	nuclear emergency preparedness
Ni	nickel
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-basis earthquake
OCA	owner-controlled area
OL	operating license
OSC	operational support center
OW	observation well
P	compression
PAA	protection action area
PAG	protective action guide
PAR	protective action recommendation
PAZ	protective action zone
PBMR	pebble bed modular reactor
pcf	pound(s) per cubic feet
PDS	plant data system
pga	peak ground acceleration
PGCCCD	Port Gibson/Claiborne County Civil Defense
PGCCREPP	Port Gibson/Claiborne County Radiological Emergency Preparedness Plan
PI	project instruction
PMF	probable maximum flood
PMH	probable maximum hurricane
PMP	probable maximum precipitation
PMWP	probable maximum winter precipitation
PNNL	Pacific Northwest National Laboratory
PPBA	proposed powerblock area
PPE	plant parameter envelope
P-S	compression and shear
psf	pound(s) per square feet
PSHA	probabilistic seismic hazard analysis
psi	pound(s) per square inch
Q	seismic attenuation parameter
PWR	pressurized-water reactor

QA	quality assurance
QAPM	quality assurance program manual
QAPPD	quality assurance project planning document
RAA	remote assembly area
RACES	radio amateur civil emergency service
rem	roentgen equivalent man
RAI	request for additional information
RC	resonant column
REP	radiological emergency plan
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	shear
Sa	spectral acceleration
SC	clayey sand
SCR	stable continental region
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
SMEPA	South Mississippi Electric Power Association
SMRAP	Southern Mutual Radiation Assistance Plan
SOG	Seismicity Owners Group
SOP	standard operating procedure
SP	poorly grade sand
SPF	standard project flood
SPT	standard penetration test
Sr	strontium
SRCC	Southern Regional Climate Center
SRP	Standard Review Plan
SRSZ	Saline River Source Zone
SSAR	site safety analysis report
SSC	structure, system, and component
SSE	safe-shutdown earthquake
SSI	soil structure iteration
SWR	service water reservoir
TEDE	total effective dose equivalent
TID	technical information document
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
UHRS	uniform hazard response spectrum
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USCS	unified soil classification system
UT	University of Texas
UTM	universal transverse mercator
V/H	vertical-to-horizontal
WHTF	waste heat treatment facility
WLA	William Lettis & Associates
WUS	western United States
YMCA	Young Men's Christian Association

1. INTRODUCTION AND GENERAL DESCRIPTION

1.1 Introduction

System Energy Resources, Inc. (SERI or the applicant), 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 the applicant designated 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 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 manmade 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 the requirements of 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 a new nuclear unit(s) were eventually to be constructed at the ESP site.

The SERI ESP application includes the site safety analysis report (SSAR), which describes the 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. ML060830203. The documents are also available for public inspection at the NRC Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, and at the Harriette Person Memorial Library in Port Gibson, Mississippi. This SER is available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html. This SER is also available in ADAMS under Accession No. ML052860041. SERI revised its application to address the NRC staff requests for additional information (RAIs); updated versions of the ESP application are also available at these same locations. The NRC verified that revision of the SERI ESP application is consistent with information provided in the applicant's RAI responses.

[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 SER available on the NRC's new reactor licensing public Web site at http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html.

This verification closed Confirmatory Item 1.1-1 identified in the draft safety evaluation report (DSER) for the Grand Gulf ESP site, issued April 7, 2005.

This report summarizes the results of the NRC staff's technical evaluation of the suitability of the proposed Grand Gulf ESP site for a nuclear power plant or plants falling within the plant parameter envelope (PPE) that SERI specified in its application. This SER delineates the scope of technical matters the staff considered in evaluating the suitability of the site. NRC Review Standard (RS)-002, "Processing Applications for Early Site Permits," issued May 2004, provides additional details on the scope and bases of the staff's review of the radiological safety and emergency planning aspects of a proposed nuclear power plant site. This review standard contains regulatory guidance based on NUREG-0800, Revision 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," issued July 1981 (hereinafter referred to as the Standard Review Plan). The Standard Review Plan 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. In addition, this SER documents the resolution of the open and confirmatory items identified in the DSER.

The applicant also filed an environmental report for the Grand Gulf ESP site in which it evaluated those matters relating to the environmental impact assessment that can be reasonably reviewed at this time. The staff discussed the results of its evaluation of the environmental report for the Grand Gulf ESP site in a draft environmental impact statement issued on April 21, 2005 (ADAMS Accession No. ML051110531; also available on the NRC reactor licensing public web site). The applicant has no plans to perform activities at the Grand Gulf ESP site under 10 CFR 50.10(e)(1) after receiving an ESP; therefore, it did not provide a site redress plan.

As described above, the applicant supplemented the information in the SSAR by providing revisions to the document. The staff reviewed these revisions to determine their impact on the conclusions in this SER. On October 21, 2005, the NRC issued its SER for the Grand Gulf ESP site and in light of a concern raised by the ACRS on the nature of the proposed site, the staff requested that SERI provide additional information to demonstrate compliance with 10 CFR Part 100. By letter dated March 8, 2006, SERI provided Revision 3 to the Grand Gulf ESP application. The changes reflected in Revision 3 of the application include SERI's alternate methodology for demonstrating compliance with 10 CFR Part 100. The majority of the differences between the October 21, 2005 FSER and this report are documented in section 2.2.3 of this report. The staff completed its review of the most recent version, Revision 3 of the SSAR, as documented throughout this report and, for the reasons set forth herein, finds it to be acceptable. 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.

Appendix A to this SER contains the list of site characteristics, permit conditions, combined license (COL) action items, and the bounding parameters that the staff is recommending that the Commission include in any ESP that might be issued for the proposed site. Appendix B to this SER 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 C lists the references for this SER, Appendix D identifies the principal contributors to this report, and Appendix E includes a copy of the report by the ACRS.

1.2 General Site Description

The 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 is adjacent to the existing GGNS Unit 1, which 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 an ESP applicant to 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 SSAR, SERI provided a list of postulated design parameters, referred to as the plant parameter envelope (PPE). The applicant stated that the PPE approach provides sufficient design details to support the NRC's review of the ESP application, while recognizing that new reactor technologies, not envisioned at the time SERI submitted its ESP application, may become available in the future. Therefore, the applicant stated that it based the PPE on data from selected reactor designs and that the PPE is intended to bound multiple reactor designs. The applicant also stated that the actual reactor design selected would be reviewed at the COL stage to ensure that the design fits within the PPE.

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 a 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, it had 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 from different vendors.

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 be reasonable for a reactor(s) 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 that they were not unreasonable. As previously noted, the applicant identified certain PPE values as appropriate for inclusion in an ESP, should one be issued. The staff also reviewed the applicant's proposed list of PPE values and identified certain PPE values as bounding parameters or controlling PPE values as discussed in the individual sections of this SER. A controlling PPE value, or bounding parameter value, is one that necessarily depends on a site characteristic. As the PPE is intended to bound multiple reactor designs, the NRC staff would review the actual design selected in a COL or construction permit (CP) application referencing any ESP that might be issued in connection with this application to ensure that the design fits within the bounding parameter values. Appendix A to this SER lists the bounding parameters identified for the Grand Gulf ESP site.

Should an ESP be issued for the Grand Gulf ESP site, an entity might wish to reference that ESP, as well as a certified design, in a COL or CP application. Such a COL or CP applicant must demonstrate that the site characteristics established in the ESP bound the postulated site

parameters established for the chosen design, and that the design characteristics of the chosen design fall within the bounding parameter values specified in the ESP. Otherwise, the COL or CP applicant must demonstrate that the new design, given the site characteristics in the ESP, complies with the Commission's regulations. Should an entity wish to reference the ESP and a design that is not certified, the COL or CP applicant must demonstrate that the characteristics of the chosen design, in conjunction with the site characteristics established for the ESP, comply with the Commission's 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 SER 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 a new nuclear unit(s) that might be constructed on the ESP site posed by manmade 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 a new nuclear unit(s) with design parameters falling within those specified in the applicant's PPE under the requirements of 10 CFR Part 52 and 10 CFR Part 100

- suitability of the site for developing adequate physical security plans and measures for a 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 a 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 local 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 B 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 a result of its review of SERI's application for the Grand Gulf ESP, the staff identified several issues that remained open at the time the DSER was issued. The staff considers an issue to be open if the applicant has not provided requested information and the staff is unaware of what will ultimately be included in the applicant's response. The staff assigned each of these issues a unique identifying number for tracking purposes that indicates the section of this report in which it is described. The resolution of each open item is discussed in the SER section in which it appears. For example, Section 2.1 of this report discusses Open Item 2.1-1.

In addition, the staff identified two confirmatory items in the DSER. An item is identified as confirmatory if the staff and the applicant have agreed on a resolution of the particular item, but the resolution has not yet been formally documented. The confirmatory item identified by the staff, which is discussed in detail in Section 17.3 of this SER, required verification of information obtained from the Internet. The staff determined that the applicant provided adequate quality assurance measures to authenticate and verify data retrieved from Internet Web sites and thus considers this confirmatory item complete.

The DSER was issued with 23 open items and two confirmatory items. As set forth in this report, all open items have been resolved and the confirmatory items have been completed. This SER documents the resolution of all the open and confirmatory items identified in the DSER.

1.7 Summary of Combined License Action Items

The staff has 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. This report refers to these items as COL action items. These COL action items relate to issues that are outside the scope of the SER. The COL action items do not establish requirements; rather, they identify a set of information to be

included in the site-specific portion of the safety analysis report submitted by a COL or CP applicant referencing the Grand Gulf ESP. An applicant for a COL or CP should address each of these items in its application. The staff determined that the COL action items do not affect its regulatory findings at the ESP stage and are, for reasons specified in this report for each item, more appropriately addressed at later stages in the licensing process.

At the time the DSER was issued, there were 18 COL action items. The staff reviewed the responses to open items provided by the applicant and identified a number of new COL action items as a result. This report highlights these COL action items, and the staff explains them in the applicable sections of this SER. Appendix A to this SER includes a list of COL action items that must be addressed by a future COL or CP applicant. 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. The list of COL action items is not and should not be considered exhaustive.

1.8 Summary of Permit Conditions

The staff has identified certain permit conditions that it will recommend the Commission impose, should an ESP be issued to the applicant. Appendix A to this SER summarizes these conditions. These permit conditions, or limitations on the ESP, stem from the provisions of 10 CFR 52.24, “Issuance of Early Site Permit.”

At the time the DSER was issued, the staff had proposed a total of 10 permit conditions. This report discusses these permit conditions, which are identified with a unique assigned number to indicate the corresponding section of the DSER in which the condition was described. The applicant provided responses to the DSER open items which resulted in the resolution of some proposed DSER permit conditions. In addition, the staff determined that a permit condition is not necessary when an existing NRC regulation requires a future regulatory review and approval process to ensure adequate safety during design, construction, or inspection activities for a new plant. Based on this criterion, the staff removed a number of permit conditions proposed in the DSER and, in some cases, added new permit conditions, COL action items, or site characteristics, as appropriate, to account for the concern.

Appendix A to this SER contains the final list of permit conditions which have been highlighted throughout this report. Each permit condition has been reassigned a number identifying the sequence in which it appears in the SER. An explanation of each permit condition is provided in the applicable section of this report.