Safety Evaluation of the Early Site Permit Application in the Matter of Southern Nuclear Operating Company, for the Vogtle Early Site Permit Site

U. S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

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ABSTRACT

This safety evaluation report[1](SER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's technical review of the site safety analysis report (SSAR) and emergency planning information included in the early site permit (ESP) application submitted by Southern Nuclear Operating Company (SNC or the applicant), for the Vogtle Electric Generating Plant (Vogtle or VEGP) site. The SER also documents the NRC staff's technical review of the limited work authorization (LWA) activities for which SNC has requested approval.

By letter dated August 14, 2006, SNC submitted an ESP application for the VEGP site in accordance with Subpart A, "Early Site Permits," of Title 10 of the Code of Federal Regulations (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The VEGP site is located in Burke County, Georgia, approximately 26 miles southeast of Augusta, Georgia. In its application, SNC seeks an ESP that could support a future application to construct and operate additional nuclear power reactors at the ESP site with a total nuclear generating capacity of up to 6800 megawatts thermal (MWt). The proposed ESP Units 3 and 4 would be built on the VEGP site adjacent to and west of two existing nuclear power reactors operated by SNC.

By letter dated August 16, 2007, SNC also submitted an LWA request in accordance with 10 CFR 52.17(c). The activities that SNC requested under its LWA are limited to placement of engineering backfill, retaining walls, lean concrete backfill, mudmats, and waterproof membrane.

This SER presents the results of the staff's review of information submitted in conjunction with the ESP and LWA 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 (COL) or construction permit (CP) stage, should the applicant desire to construct one or more new nuclear reactors on the VEGP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP or LWA stage and are, for reasons specified in Section 1.7 of the SER, more appropriately addressed at later stages in the licensing process. Appendix A to this SER also identifies the proposed permit conditions, site characteristics, bounding parameters, and inspections, tests, analyses and acceptance criteria (ITAAC) that the staff recommends the Commission impose, should an ESP and an LWA be issued to the applicant.

[1] This SER documents the NRC staff's position on all safety issues associated with the early site permit application and limited work authorization request. This SER has not undergone a final review by the Advisory Committee on Reactor Safeguards (ACRS) and is therefore subject to change. Following the ACRS review, the staff will issue the final safety evaluation report (FSER). Therefore, although the staff may refer to the "FSER" throughout, this report is considered the advanced safety evaluation report with no open items until the ACRS has completed its review and the staff issues the document as a final report.

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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 consistent with the format of (1) NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (2) Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants," and (3) the applicant's site safety analysis report. Numerous sections and chapters in the NUREG-0800 are not within the scope of or addressed in an Early Site Permit (ESP) or Limited Work Authorization (LWA) Request proceeding. The reader will therefore note "missing" chapter and section numbers in this document. The subjects of chapters and section in NUREG-0800 not addressed herein will be addressed, as appropriate and applicable, in other regulatory actions (design certifications, construction permit, or combined license) for a reactor or reactors that might be constructed on the Vogtle ESP site.

APPENDICES

FIGURES

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EXECUTIVE SUMMARY

The regulations at 10 CFR Part 52 contain requirements for licensing new nuclear power plants.[2] These regulations include the NRC's requirements for early site permits (ESP), design certification, and combined license (COL) applications. The ESP process (10 CFR Part 52, Subpart A) 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 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. A COL may reference an ESP, a certified design, both, or neither. A COL applicant referencing an ESP or certified design must resolve any licensing issues that were not resolved as part of the referenced ESP or design certification proceeding before the NRC issues that COL. In addition, an applicant may request a limited work authorization (LWA) for approval of a limited set of construction activities in accordance with 10 CFR 50.10(d). Pursuant to 10 CFR 50.10(d)(3), an LWA request must contain the design and construction information otherwise required by the Commission's rules and regulations to be submitted for a combined license, but limited to those portions of the facility that are within the scope of the LWA. Pursuant to 10 CFR 50.10(d)(2), this request may come from an ESP applicant, and pursuant to 10 CFR 52.17(c), an ESP applicant may request that an LWA be issued in conjunction with the ESP.

This SER describes the results of a review by the NRC staff of both an ESP application and an associated LWA request submitted by Southern Nuclear Operating Company (SNC, or the applicant) for the Vogtle Electric Generating Plant (VEGP) site. The staff's review was to determine the applicant's compliance with the requirements of Subpart A of 10 CFR Part 52 as well as the applicable LWA requirements under 10 CFR Part 50. The SER serves to identify the staff's conclusions with respect to the ESP and LWA safety review and to identify items that would need to be addressed by a future COL applicant referencing a Vogtle ESP.

The NRC 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 Functions." 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 in a final environmental impact statement (FEIS), which is a report separate from this SER. The staff's FEIS, NUREG-1872, "Final Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site," for the ESP application and LWA request was issued in August 2008, and can be accessed through the agencywide documents access and management system (ADAMS) at ML082260190.

By letter dated August 14, 2006, SNC, acting on behalf of itself and Georgia Power Company (GPC), Oglethorpe Power Corporation (an electric membership corporation), Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners,

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2 Applicants may also choose to seek a CP 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.

submitted an ESP application (ADAMS Accession No. ML062290246)[3] for the VEGP site. The VEGP site is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County, Georgia. The site is approximately 26 miles southeast of Augusta, Georgia and 100 miles northwest of Savannah, Georgia. Directly across from the site, on the eastern side of the Savannah River, is the U.S. Department of Energy's (DOE's) Savannah River Site in Barnwell County, South Carolina. The proposed ESP Units 3 and 4 would be built on the VEGP site adjacent to two existing nuclear power reactors, Vogtle, Units 1 and 2, operated by SNC.

By letter dated August 16, 2007, SNC and its affiliates also submitted an LWA request in accordance with 10 CFR 52.17(c). The activities that SNC requested under its LWA are limited to placement of engineering backfill, retaining walls, lean concrete backfill, mudmats, and a waterproof membrane.

In accordance with 10 CFR Part 52, the VEGP application includes: (1) a description of the site and nearby areas that could affect or be affected by a nuclear power plant(s) located at the site; (2) a safety assessment of the site on which the facility would be located, including an analysis and evaluation of the major structures, systems, and components (SSC) of the facility that bear significantly on the acceptability of the site; (3) complete and integrated emergency plans; and (4) a safety assessment of the construction activities requested under the LWA. The application describes how the site, and the requested construction activities under the LWA, complies with the applicable requirements of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," 10 CFR Part 52 and the siting criteria of 10 CFR Part 100, "Reactor Site Criteria."[4]

The SER presents the conclusions of the staff's review of the ESP application and associated LWA request. The staff has reviewed the information provided by the applicant to resolve the open items identified in the SER with open items for the VEGP ESP, issued on August 30, 2007 (ML071581032). In addition, the staff has reviewed the information provided by the applicant in response to requests for additional information (RAI) pertaining to both the ESP application and the LWA request. In Section 1.5 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 are presented in the corresponding sections of this report.

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3 ADAMS (Agencywide Documents Access and Management System) 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 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-reactors/esp/vogtle.html.

4 The applicant has 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 SER describes the staff's evaluation of information submitted by the applicant to address GDC 2 with respect to the ESP application. Furthermore, with the applicant's submission of the LWA request, the staff also considered the application's compliance with GDC 1, "Quality Standards and Records," with respect to safety-related structures being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

The staff identified, in Appendix A to this SER, the proposed permit conditions that it will recommend the Commission impose, if an ESP is 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 at the COL or CP stage, if the applicant desires to construct one or more new nuclear reactors on the VEGP site and references the Vogtle ESP in its application. The staff determined that these items are not required for the staff to make its regulatory findings on the ESP or LWA and are, for reasons specified in Section 1.6, more appropriately addressed at a later stage in the licensing process. In addition, Appendix A lists the site characteristics, bounding parameters, and the inspections, tests, analyses, and acceptance criteria (ITAAC) that the staff recommends the Commission impose, should an ESP and an LWA be issued to the applicant.

Inspections conducted by the NRC have verified, where appropriate, the conclusions in this SER. The inspections focused on selected information in the ESP application and its references. The SER 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 SER, 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.

ABBREVIATIONS

ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ADL	administrative decision line
AF	amplification functions
AFCCC	Air Force Combat Climatology Center
ALARA	as low as reasonably achievable
ALI	annual limits on intake
ANS	American Nuclear Society
ANSI	American National Standards Institute
ANSS	Advanced National Seismic System
ARC	American Red Cross
AREOP	Annual Radiological Environmental Operating Report
ASB	Auxiliary Shield Building
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
ATWS	anticipated transients without scram
BBM	Blue Bluff Marl
bpf	blows per foot
BE	best estimate
Bechtel	Bechtel Power Corporation
BLWM	Bureau of Land and Waste Management
BOP	Behavioral Observation Program
BRH	Bureau of Radiological Health
CADD	computer-aided design and drafting
CAR	Corrective Action Reports
C/D	capacity over demand
CDE	committed dose equivalent
CEUS	Central and Eastern United States
cfps	cubic feet per second
CFR	Code of Federal Regulations
CIS	Containment Internal Structure
COL	Combined Operating License
CP	construction permit
cpm	counts per minute
CPT	(seismic) cone pentrometer test
CR	condition report
CRR	cyclic resistance ratio
Cs	cesium
CSDRS	Certified Design Response Spectra
CSR	cyclic stress ratio
CU	consolidated undrained
CVSZ	Central Virginia Seismic Zone

D	distance
DAC	derived air concentrations
DBA	design-basis accident
Dbar	mean distance
DC	design certification
DCD	design certification document
DEIS	Draft Environmental Impact Statement
DEM	digital elevation model
DF	design factor
DFCS	Department of Family and Children Services
DG	Draft Regulatory Guide
DHEC	Department of Environmental Control
DHS	Department of Homeland Security
DNR	Department of Natural Resources
DOE	Department of Energy
DOE-SR	Department of Energy, Savannah River Site
DOT	Department of Transportation
DQ	deposition factors
DS	document services
E	elastic modulus
EAB	exclusion area boundary
EAL	emergency action levels
EAS	emergency alert system
ECFS	East Coast Fault System
ECL	emergency classification levels
ECMA	East Coast Magnetic Anomaly
EF	Enhanced Fujita
EIP	emergency implementing procedures
EI.	elevation
EMA	Emergency Management Agency
EMS	emergency medical services
ENC	Emergency News Center
ENN	Emergency Notification Network
ENS	emergency notification system
ENS	emergency operations center
EOC	emergency operations facility
EOF	emergency operations facility
EOP	emergency operating procedures
EPA	Environmental Protection Agency
EPC	emergency preparedness coordinator
EPD	Environmental Protection Division
EPIP	emergency plan implementing procedures
EPRI	Electric Power Research Institute
EPZ	emergency planning zones
ER	Environmental Report
ERDS	emergency response data system
ERF	emergency response facility
ERO	emergency response organization
ESBWR	Economic Simplified Boiling Water Reactor
ESF	Emergency Support Function
ESP	Early Site Permit

EST	Earth Science Team
ETE	evacuation time estimate
ETML	elevated temperature material liquid
ETSZ	Eastern Tennessee Seismic Zone
ETV	Educational Television Network
EW	East, West
FA	felt area
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	final environmental impact statement
FEMA	Federal Emergency Management Agency
FEOC	Forward Emergency Operations Center
FERC	Federal Emergency Regulatory Commission
FIRS	foundation input response spectra
FNARS	Federal National Alert Radio System
FNF	fixed nuclear facility / facilities
FOSID	frequency of onset of inelastic deformation
fps	feet per second
FRC	Federal Response Center
FRERP	Federal Ragiological Emergency Response Plan
FRMAC	Federal Radiological Monitoring and Assessment Center
FS	factors of safety
FSAR	final safety analysis report
FSER	final safety evaluation report
ft	feet / foot
GA	Georgia
GA REP	Georgia Radiological Emergency Plan
GBU	Global Business Unit
GCSZ	Giles County Seismic Zone
GDC	general design criteria
Ge (Li)	lithium drifted germanium
GEMA	Georgia Emergency Management Agency
GEOP	Georgia Emergency Operations Plan
GET	general employee training
GIS	geographical information system
GL	Generic Letter
GMRS	ground motion response spectra
GPC	Georgia Power Company
h	hour
HEC	Hydrologic Engineering Center
HEC-RAS	Hydrologic Engineering Center River Analysis System
HEPA	high-efficient particulate air
HHS	Department of Health and Human Services
HMR	hydrometeorological Report
HP	health physics
HPN	Health Physics Netowrk
I	Iodine
IBR	incorporated by reference
IC	initiating condition
ICC	Intrastate Coordinating Channel
IEEE	Institute of Electrical and Electronic Engineers

IEM	Innovative Emergency Management, Inc.
in.	inch(es)
INPO	Institute of Nuclear Power Operators
IPCC	Intergovernmental Panel on Climate Change
IPZ	Ingestion Pathway Emergency Planning Zone
ITAAC	inspections, tests, analyses, and acceptance criteria
JFD	joint frequency distribution
JIC	joint information center
KI	potassium iodide
kPa	kilopascals
LB	lower bound
lbf/ft^2	pounds-force per square foot
LGR	local government radio
LLEA	local law enforcement agencies
LLNL	Lawrence Livermore National Laboratory
LOCA	loss-of-coolant accident
LPZ	low population zone
LWA	limited work authorization
LWR	light-water reactor
m	meter
M	moment magnitude
Mbar	mean magnitude
MbLg	body-wave local magnitude
M&TE	measuring and test equipment
m/s	meters per second
MACTEC	MACTEC Engineering and Consulting, Inc.
MAST	Military Assistance to Safety and Traffic
Mbar	mean magnitude
MEI	maximally exposed individual
MGD	million gallons a day
mGy	milliGray
mi	miles
MIDAS	Meteorological Information and Dispersion Assessment System
MLW	mean low water
ML	local magnitude
Mmax	largest maximum magnitude
MM	modified mercalli
MMI	modified mercalli intensity
MOA	Military Operation Area
MOU	memorandum of understanding
MOX	mixed oxide
MPA	methoxypropylamine
MPA	methoxypropylamine
mrad	milliard
mrem	millirem
MRO	Medical Review Officer
m/s	meters per second
MS	surface-wave magnitude
MSE	mechanically stabilized earth
msl	mean sea level
mSv	milliSieverts

MWt	megawatts thermal
mya	million years ago
NaI	sodium iodide
NAWAS	National Warning System
NCDC	National Climatic Data Center
ND	Nuclear Development
NDQAM	Nuclear Development Quality Assurance Manual
NEI	Nuclear Energy Institute
NGDC	National Geophysical Data Center
NHC	National Hurricane Center
NI	nuclear island
NIRMA	Nuclear Information and Records Management Association
NIST	National Institute of Standards and Technology
NMSZ	New Madrid Seismic Zone
NOAA	National Oceanic and Atmospheric Administration
NOAA-CSC	National Oceanic and Atmospheric Administration-Coastal Services Center
NQA	nuclear quality assurance
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission
NREES	Nuclear Response and Emergency Environmental Surveillance Section
NRP	National Response Plan
NS	North, South
NSSL	National Severe Storms Laboratory
NSSS	nuclear steam supply system
NUREG	NRC technical report (Nuclear Regulatory Commission)
NVLAP	National Voluntary Laboratory Accreditation Program
NWR	National Weather Radio
NWS	National Weather Service
NYAL	New York-Alabama Lineament
OBE	operating basis earthquake
OCA	owner-controlled area
OCGA	Official Code of Georgia Annotated
ODCM	Offsite Dose Calculation Manual
OHS	Office of Homeland Security
ORHMC	Oak Ridge Hospital of the Methodist Church
OSC	operational support center
OSID	onset of significant inelastic deformation
OWA	owner-controlled area
PA	protected area
PAG	protective action guideline
PAR	protective action recommendation
PCS	Passive containment cooling system (NRC defines passive containment system)
pcf	per cubic foot
PFT	performance frequency values
PGA	Peak Ground Acceleration
PI	plasticity index
PIO	public information officer
PMF	probable maximum flood
PMH	probable maximum hurricane

PMP	probable maximum precipitation
PMWP	probable maximum water precipitation
PNS	prompt notification system
PO	purchase order
PPM	parts per million
PQAM	Project Quality Assurance Manager
P-S	primary and secondary
psf	pounds per square foot
PSHA	probabilistic seismic hazard analysis
psi	pounds per square inch
PWR	pressurized-water reactor
QA	quality assurance
QAPD	Quality Assurance Program Description
QAPP	Quality Assurance Program Plan
RAI	Request for Additional Information
RAP	Radiological Assistance Program
RASCAL	Radiological Assessment System for Consequence Analysis
RCL	Record Control Log
RCTS	resonant column torsional shear
REI	Risk Engineering, Inc.
ReMi	refraction microtremor
REP	radiological emergency preparedness
RER	radiological emergency response
RERP	radiological emergency response plan
RG	Regulatory Guide
RIS	Regulatory Issue Summary
RMC	Radiation Management Consultants
RQD	Rock Quality Designations
RS	Review Standard
RWP	radiation work permit
SASSI	System for Analysis of Soil-Structure Interaction
SASW	Spectral Analysis of Surface Waves
SCDF	seismic core damage frequencies
SCDOT	South Carolina Department of Transportation
SCEMD	South Carolina Emergency Management Division
SCEOP	South Carolina Emergency Operations Plan
SCETV	South Carolina Educational Television Network
SCOL	Subsequent Combined Operating License
SCORERP	South Carolina Operational Radiological Emergency Response Plan
SCR	stable continental region
SCS	Southern Company Services, Inc.
SCTRERP	South Carolina Technical Radiological Emergency Response Plan
SCV	steel containment vessel
SEI	Structural Engineering Institute
SEN	sensitivity
SEOC	State Emergency Operations Center
SER	safety evaluation report
SERCC	Southeast Regional Climate Center
SERT	State Emergency Response Team
SEUSS	South Eastern United States Seismic Network
SL	severity level

SLED	South Carolina Law Enforcement Division
SMRAP	Southern Agreement for Mutual State Radiation Assistance Activation Procedure
SNC	Southern Nuclear Operating Company
SOC	State Operations Center
SOP	Standard Operating Procedure
SP	light gray sand
SPF	Standard Project Flood
SPT	Standard Penetration Test
SQAP	Software Quality Assurance Plan
Sr	strontium
SR	standard review
SRNL	Savannah River National Laboratory
SRP	Standard Review Plan
SRS	Savannah River Site
SSAR	site safety analysis report
SSC	structures, systems and components
SSE	safe-shutdown earthquake
SSHAC	Senior Seismic Hazard Advisory Committee
SSI	soil-structure-interaction
TAG	Technical Advisory Group
TEDE	total effective dose equivalent
TFI	technical facilitator/integrator
TI	Technical Integrator
TIP	Trial Implementation Project
TLD	thermoluminescent dosimeter
TNT	trinitrotoluene
TSC	technical support center
TtNUS	Tetra Tech, Inc.
TV	threshold value
UB	upper bound
UCSS	Updated Charleston Seismic Source
UFL	Upper Flammability Limit
UFSAR	undated final safety analysis report
UHRS	uniform hazard response spectrum
UHS	ultimate heat sink
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USCB	U. S. Census Bureau
USDA	U. S. Department of Agriculture
USGS	U. S. Geological Survey
UTM	Universal Transverse Mercator
UTS	Universal Transverse Mercator
UU	unconsolidated undrained
V/H	vertical-to-horizontal
VEGP	Vogtle Electric Generating Plant
VHF	very high frequency
VOAD	Voluntary Organizations Active in Disaster
Vs	shear wave velocity
WEC	Westinghouse Electric Company, LLC
WLA	William Lettis & Associates

WMA	Wildlife Management Area
WSRC	Washington Savannah River Company
WUS	Western United States
yd(s)	yard(s)
ZRA	zone of river anomalies

1.0 INTRODUCTION AND GENERAL DESCRIPTION

1.1 Introduction

By letter dated August 14, 2006, SNC, acting on behalf of itself and Georgia Power Company (GPC), Oglethorpe Power Corporation (an electric membership corporation), Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners, submitted an early site permit (ESP) application (ADAMS Accession No. ML062290246) for the Vogtle Electric Generating Plant (VEGP) site. The proposed site is located in eastern Burke County, GA, approximately 26 miles (mi) southeast of Augusta, GA, and approximately 100 mi northwest of Savannah, GA. The NRC docketed the application on September 19, 2006. Pursuant to Subpart A of 10 CFR Part 52, SNC requested an ESP with a permit duration of 20 years. On August 16, 2007, SNC submitted a limited work authorization (LWA) request for approval of construction activities including the placement of engineered backfill, retaining walls, lean concrete backfill, mudmats, and a waterproof membrane, in accordance with 10 CFR 52.17(c). Pursuant to 10 CFR 50.10(d)(3), an LWA request must contain the design and construction information otherwise required by the Commission's rules and regulations to be submitted for a combined license, but limited to those portions of the facility that are within the scope of the LWA.

The staff has completed its review of the information presented in the VEGP application concerning the site's meteorology, hydrology, geology, and seismology, as well as the potential 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 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 in accordance with the measures discussed in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50. The staff reviewed the complete and integrated emergency plans that SNC would implement if a new reactor(s) is eventually constructed at the ESP site.

In addition, the staff reviewed the technical information presented in the VEGP application pertaining to the LWA activities being requested. Specifically, the staff reviewed the applicant's seismic design, seismic systems, and foundations, as they relate to the LWA activities being requested. The staff also evaluated the applicant's fitness for duty program in accordance with the requirements in 10 CFR Part 26 that are applicable to the requested LWA construction activities.

The VEGP application includes the SSAR, which describes a safety assessment of the site, as required by 10 CFR 52.17, "Contents of Applications." The public may inspect copies of the ESP application in ADAMS under Accession No. ML081020073. The application is also available for public inspection at the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, MD 20852, and at the Burke County Public Library, 130 Highway 24 South, Waynesboro, GA 30830.

The applicant submitted the most recent version of its application, SSAR Revision 4 (ADAMS Accession No. ML081020073), to the Commission by letter dated March 28, 2008. As a result

of staff requests for additional information (RAIs), the applicant intends to submit Revision 5 to the SSAR. Although the staff has not yet received and reviewed SSAR Revision 5, the staff has documented in this safety evaluation report (SER)[5] its review of SNC's responses to RAIs, which were provided under oath or affirmation. The staff does not expect Revision 5 will contain any additional information not already reviewed by the staff in SNC's responses to RAIs. However, following SNC's submission of SSAR Revision 5, the staff will confirm that the changes made to the SSAR match those represented by SNC in its RAI responses. The staff plans to document that confirmation in its final safety evaluation report (FSER) scheduled for issuance February 2009. The staff has identified this as **Confirmatory Item 1.1-1**. As updated versions of the ESP application are received, they will also be available to the public in ADAMS and at the locations discussed above.

This SER documents the staff's technical evaluation of the suitability of the proposed VEGP site for construction and operation of a nuclear power plant(s) falling within the design parameters that SNC specified in its application. It also documents the results of the staff's technical evaluation of the limited construction activities proposed under SNC's LWA request. The SER delineates the scope of the technical matters that the staff considered in evaluating the suitability of the site and the LWA request. NRC Review Standard (RS)-002, "Processing Applications for Early Site Permits," Attachment 2, provides guidance for the staff in conducting its review of the radiological safety and emergency planning aspects of a proposed nuclear power plant site. RS-002, Attachment 2, 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.) In addition to RS-002, the SRP provides the regulatory guidance applied by the staff in its review of the LWA request. The SRP reflects the staff's many years of experience in establishing and promulgating guidance to enhance the safety of nuclear facilities, as well as in performing safety assessments.

The applicant also filed an environmental report for the VEGP 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 VEGP site in a final environmental impact statement (FEIS) issued in August 2008 (ML082260190). The applicant has also provided a site redress plan, in accordance with 10 CFR 52.17(c), in order to perform the LWA activities specifically requested in the application. The FEIS documents the staff's evaluation of the SNC site redress plan.

Appendix A to this SER contains the list of site characteristics, permit conditions, COL action items, and the bounding parameters, and inspections, tests, analyses and acceptance criteria (ITAAC) that the staff recommends the Commission include in any ESP and LWA that might be issued for the proposed site. Appendix B to the SER is a chronology of the principal actions and correspondence related to the staff's review of the ESP and LWA application for the VEGP site. Appendix C lists the references for this SER, and Appendix D lists the principal contributors to this report.

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[5] This SER documents the NRC staff's position on all safety issues associated with the early site permit application and limited work authorization request. This SER has not undergone a final review by the Advisory Committee on Reactor Safeguards (ACRS) and is therefore subject to change. Following the ACRS review, the staff will issue the final safety evaluation report (FSER). Therefore, although the staff may refer to the "FSER" throughout this report is considered the advanced safety evaluation report with no open items until the ACRS has completed its review and the staff issues the document as a final report.

1.2 General Site Description

Proposed ESP Units 3 and 4 are planned to be built on the VEGP site. The VEGP site, which spans 3,169 acres, is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County. The site is approximately 15 miles east-northeast of Waynesboro, GA, 26 miles southeast of Augusta, GA, and it is also approximately 100 miles from Savannah, GA. Directly east of the site, across the Savannah River, is the U.S Department of Energy's (DOE) Savannah River Site.

Numerous small towns exist within 50 miles of the site. U.S. Interstate Highway No. I-20 (I-20), a major interstate highway, crosses the northern portion of the 50-mile radius. The site can be accessed through U.S. Route 25; Georgia State Routes 23, 24, 56, and 80; and New River Road. A navigation channel is authorized on the Savannah River from the Port of Savannah to Augusta, GA, and a railroad spur connects the site to the Norfolk Southern Savannah-to-Augusta track. The applicant's SSAR Figures 1-1 and 1-2 show the site location and the area within a 6-mile and 50-mile radius. Section 2.1 of this SER discusses the site location in more detail.

With regard to the existing development of the site, the VEGP site currently has two Westinghouse pressurized water reactors (PWRs), rated at 3,625.6 Mwt. Also on the site are their supporting structures, which include two natural-draft cooling towers (one per unit), associated pumping and discharge structures, water treatment building, switchyard, and training center. Plant Wilson, a six-unit, oil-fueled combustion turbine facility, is also located on the VEGP site, east of Units 1 and 2. The applicant's SSAR Figure 1-3 shows the current VEGP site plan.

With regard to the proposed development of the site, the new plant footprint selected for proposed Units 3 and 4 is adjacent to the west side of the VEGP Units 1 and 2. The footprint is shown on the applicant's SSAR Figure 1-4.

The applicant has referenced the Westinghouse AP1000 certified reactor design for both the ESP application and the LWA request. The applicant's SSAR Section 1.3 identifies the design parameters, site characteristics, and site interface values used in the development of the application. The design parameters are based on the addition of two Westinghouse AP1000 units, to be designated Vogtle Units 3 and 4. The AP1000 has a thermal power rating of 3,400 MWt and a net electrical output of 1,117 megawatts electric. While the staff considered design parameters of the AP1000 certified design in order to make its ESP findings concerning site suitability, issuance of a Vogtle ESP does not constitute approval of future construction of the AP1000 certified design at the Vogtle site. If a CP or COL applicant references a Vogtle ESP in its application, the staff's CP or COL stage review would determine whether the reactor design that is ultimately selected by that applicant falls within the site characteristics and design parameters specified in the ESP. Likewise, while the LWA application references applicable design parameters of the AP1000 certified design, the staff's LWA review addresses only those aspects of the AP1000 design that are within the scope of that request.

1.3 Identification of Agents and Contractors

SNC, acting on behalf of itself and the owners of the VEGP site, is the applicant for the ESP and the LWA and has been the only participant in the review of the suitability of the VEGP site for a

nuclear power plant. Bechtel Power Corporation (Bechtel) served as the principal contractor for the development of the SSAR portion of the ESP application and Tetra Tech NUS, Inc. (TtNUS), to assist with preparing the environmental report portion. Both Bechtel and TtNUS supplied personnel, systems, project management, and resources to work on an integrated team with SNC.

Several subcontractors also assisted in the development of SNC's ESP and LWA application. MACTEC Engineering and Consulting, Inc. performed geotechnical field investigations and laboratory testing in support of SSAR Section 2.5, "Geology, Seismology, and Geotechnical Engineering." William Lettis & Associates, Inc. performed geologic mapping and characterized seismic sources in support of SSAR Section 2.5. Risk Engineering, Inc. performed probabilistic seismic hazard assessments (PSHA) and related sensitivity analyses in support of SSAR Section 2.5.

1.4 Summary of Principal Review Matters

This SER documents the NRC staff's technical evaluation of the VEGP site. The staff's evaluation included a technical review of the information and data the applicant submitted, with emphasis on the following principal matters:

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

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

- potential capability of the site to support the construction and operation of a nuclear power plant(s) with design parameters falling within those specified in the application under the requirements of 10 CFR Parts 52 and 100

- suitability of the site for development of adequate physical security plans and measures for a nuclear power plant(s)

- proposed complete and integrated emergency plan, should an applicant for a construction permit (CP) or combined license (COL) referencing a Vogtle ESP decide to seek a license to construct and operate a nuclear power plant(s) on the ESP site; any significant impediments to the development of emergency plans for the VEGP site; and a description of contacts and arrangements made with Federal, State, and local government agencies with emergency planning responsibilities

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

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

This SER also documents the NRC staff's technical evaluation of SNC's LWA request. The staff's evaluation included a technical review of the information and data the applicant submitted, with emphasis on the following principal matters:

- acceptability of the applicant's design properties related to the engineered backfill
- the acceptability of the applicant's mudmat and waterproof membrane design in accordance with 10 CFR 50.10(d)(3)
- quality assurance measures SNC applied to the information submitted in support of the LWA request, and will continue to apply when performing approved LWA activities
- A fitness for duty program developed, with respect to those limited construction activities requested in SNC's LWA application, to meet the applicable requirements contained in 10 CFR Part 26.

During its review, the staff held several meetings with representatives of SNC and its contractors and consultants to discuss various technical matters related to the staff's review of the VEGP site (refer to Appendix B to this SER) and LWA. The staff also visited the site to evaluate safety matters.

Appendix A to this SER includes a list of the site characteristics, bounding parameters, permit conditions, COL action items, and ITAAC that the staff recommends the Commission include in an ESP and LWA for the Vogtle site. The site characteristics are based on site investigation, exploration, analysis, and testing, performed by the applicant and are specific physical attributes of the site, whether natural or man-made. Bounding parameters set forth the postulated design parameters that provide design details to support the NRC staff's review. An explanation of COL action items, permit conditions, and ITAAC is provided below in sections 1.6, 1.7, and 1.8 respectively.

1.5 Summary of Open Items and Confirmatory Items

During its review of SNC's ESP application for the Vogtle site, the staff identified several issues that remained open at the time the SER with open items was issued on August 30, 2007. The staff considered an issue to be open if the applicant did not provide requested information and the staff did not know what would ultimately be included in the applicant's response. For tracking purposes, the staff assigned each of these issues a unique identifying number that indicated the section of this report describing it. The SER with open items was issued with 40 open items. Resolution of each open item is discussed in the SER section in which it appears. For example, Section 2.3 of this report discusses Open Item 2.3-1. As set forth in this report, all open items have been resolved.

During its review of SNC's LWA application for the Vogtle site, the staff also identified several issues for which it needed to obtain further information from the applicant. The staff relied on RAIs and site audits to resolve all outstanding issues. The staff's consideration of these RAIs, the applicant's responses to the RAIs, and the results of site audits are documented throughout this SER.

In addition, the staff has identified a confirmatory item in this report. An item is identified as a 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. Section 1.1 of this report discusses Confirmatory Item 1.1-1.

1.6 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 if a COL or CP applicant desires to construct one or more new nuclear reactors on the VEGP site and references a Vogtle ESP. This report refers to these items as COL action items. The COL action items relate to issues that are outside the scope of this SER. The COL action items do not establish requirements; rather, they identify an acceptable 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 Vogtle ESP. An applicant for a COL or CP referencing a Vogtle ESP will need to address each of these items in its application. The applicant may deviate from or omit these items, provided that the COL or CP application identifies and justifies the deviation or omission. The staff determined that the COL action items are not required for the staff to make its regulatory findings on the ESP or LWA and are, for reasons specified in this report for each item, more appropriately addressed at a later stage in the licensing process.

At the time the SER with open items was issued, there were a total of 19 COL action items. As a result of the staff's review of the open item responses, and the supplemental information provided in the LWA request, the staff was able to close out several of the COL action items. In total, there are 5 COL action items remaining. This report highlights the closure of previously identified COL action items. It also highlights the existing and new COL action items proposed by the staff.

Appendix A to this SER includes a list of the COL action items to be addressed by a future COL or CP applicant referencing a Vogtle ESP. The staff identified COL action items in order to ensure that particular significant issues are tracked and considered during the COL or CP stage. The COL action items focus on matters that may be significant in any COL or CP application referencing the ESP and LWA for the Vogtle site, if one is issued. Usually, COL action items are not necessary for issues covered by permit conditions or explicitly covered by the bounding parameters. The list of COL action items is not exhaustive with respect to the information required to meet the requirements for a CP or COL.

1.7 Summary of Permit Conditions

The staff has identified certain permit conditions that it will recommend the Commission impose if an ESP is issued to the applicant. At the time the SER with open items was issued, there were 2 permit conditions identified. As a result of the staff's review of the responses to open items, and the supplemental information provided in the LWA request, the staff identified additional permit conditions and removed one pertaining to hydrology. In total, there are 9 permit conditions identified. This report highlights the closure of the permit condition related to hydrology. It also highlights the existing and new permit conditions proposed by the staff.

Appendix A to this SER summarizes these permit conditions. Each permit condition has been assigned a number based on the order which it appears in this SER. The staff has provided an explanation of each permit condition in the applicable section of this report. These permit

conditions, or limitations on the ESP, are based on the provisions of 10 CFR 52.24, "Issuance of Early Site Permit."

1.8 Summary of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

For the reasons explained in this report, an ESP application proposing complete and integrated emergency plans for review and approval should propose the inspections, tests, and analyses that the holder of a COL referencing the ESP shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will be operated in conformity with the emergency plans, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

Likewise, if a request for a limited work authorization (LWA) is to be issued in conjunction with an ESP, it should propose the inspections, tests, and analyses that the ESP holder authorized to conduct LWA activities shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the approved construction activities will have been completed in conformity with the provisions of the Atomic Energy Act and the Commission's rules and regulations.

The staff has identified certain ITAAC that it will recommend the Commission impose with respect to an ESP and LWA issued to the applicant.. At the time the SER with open items was issued, the staff had only reviewed and included ITAAC necessary for SNC's Emergency Plans. However, as a result of the staff's review of the supplemental information provided in the LWA request, the staff reviewed and approved additional ITAAC. This report highlights the applicant's proposed ITAAC and the staff's review and approval of them. In addition, Appendix A to this SER summarizes the ITAAC approved by the staff.