

**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 report¹(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.

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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,

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.

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 penetrometer 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 |

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|--------|--|
| 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 |

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|---------|---|
| 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 Radiological 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 Network |
| I | Iodine |
| IBR | incorporated by reference |
| IC | initiating condition |
| ICC | Intrastate Coordinating Channel |
| IEEE | Institute of Electrical and Electronic Engineers |

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|---------------------|---|
| 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 |

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| MWt | megawatts thermal |
| mya | million years ago |
| Nal | 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 |

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| 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 |

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| 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 |

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|-------|-----------------------------------|
| 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.

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.