Received 4/15/08

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1437
Supplement 34

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 34

Regarding Vogtle Electric Generating Plant, Units 1 and 2

Draft Report for Comment

Office of Nuclear Reactor Regulation

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at http://www.nrc.gov/reading-rm.html.
Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the Code of *Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents
   U.S. Government Printing Office
   Mail Stop SSOP
   Washington, DC 20402-0001
   Internet: bookstore.gpo.gov
   Telephone: 202-512-1800
   Fax: 202-512-2250
2. The National Technical Information Service
   Springfield, VA 22161-0002
   www.ntis.gov
   1-800-553-6847 or, locally, 703-605-6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:
Address: U.S. Nuclear Regulatory Commission
Office of Administration
Mail, Distribution and Messenger Team
Washington, DC 20555-0001
E-mail: DISTRIBUTION@nrc.gov
Facsimile: 301-415-2289

Some publications in the NUREG series that are posted at NRC's Web site address http://www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—
The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—
American National Standards Institute
11 West 42nd Street
New York, NY 10036-8002
www.ansi.org
212-642-4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor-prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG-XXXX) or agency contractors (NUREG/CR-XXXX), (2) proceedings of conferences (NUREG/CP-XXXX), (3) reports resulting from international agreements (NUREG/IA-XXXX), (4) brochures (NUREG/BR-XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG-0750).

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1437
Supplement 34

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 34

Regarding Vogtle Electric Generating Plant, Units 1 and 2

Draft Report for Comment

Manuscript Completed: April 2008
Date Published: April 2008

Office of Nuclear Reactor Regulation

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1437, Supplement 34, draft, in your comments, and send them by July 16, 2008 to the following address:

Chief, Rulemaking, Directives and Editing Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555-0001

Electronic comments may be submitted to the NRC by the Internet at Vogtle_LR_EIS@NRC.GOV.

For any questions about the material in this report, please contact:

J.P. Leous
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Phone: 301-415-2864
E-mail: jpl1@nrc.gov

Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in 10 CFR Part 51. In the GEIS (and its Addendum 1), the Staff identified 92 environmental issues and reached generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by Southern Nuclear Operating Company, Inc. (SNC) to the NRC to renew the operating licenses for Vogtle Electric Generating Plant Units 1 and 2 (VEGP) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the Staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither SNC nor the Staff has identified information that is both new and significant for any issue that applies to VEGP. In addition, the Staff determined that information provided during the scoping process was not new and significant with respect to the conclusions in the GEIS. Therefore, the Staff concludes that the impacts of renewing the operating licenses for VEGP will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the Staff's conclusion in the GEIS is that the impact is of SMALL[a] significance (except for collective off-site radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to VEGP are addressed in this draft SEIS. The Staff concludes that the significance of potential environmental impacts related to operating license renewal is SMALL for each applicable issue, with one exception. Research is continuing in the area of chronic effects on electromagnetic fields, and a scientific consensus has not been reached. Therefore, no further evaluation of this issue is required.

(a) Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

The NRC staff's preliminary recommendation is that the Commission determines that the adverse environmental impacts of license renewal for VEGP are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by SNC; (3) consultation with Federal, State, and local agencies; (4) the Staff's own independent review; and (5) the Staff's consideration of public comments received during the scoping process.

Paperwork Reduction Act Statement

This NUREG does not contain information collection requirements and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval numbers 3150-0004; 3150-0155; 3150-0014; 3150-0011; 3150-0021; 3150-0132; 3150-0151.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

Contents

Figures

Tables

Tables

Executive Summary

By letter dated June 27, 2007, Southern Nuclear Operating Company, Inc. (SNC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Vogtle Electric Generating Plant Units 1 and 2 (VEGP) for an additional 20-year period (SNC 2007a). If the operating licenses are renewed, State regulatory agencies and VEGP will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the operating licenses are not renewed, then the plant must be shut down at or before the expiration of the current operating licenses, which expires on January 16, 2027 for Unit 1 and February 9, 2029 for Unit 2.

The NRC has implemented Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321) in Title 10 of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51). In 10 CFR 51.20(b)(2), the Commission requires preparation of an environmental impact statement (EIS) or a supplement to an EIS for renewal of a reactor operating license. In addition, 10 CFR 51.95(c) states that the EIS prepared at the operating license renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[a]

Upon acceptance of the VEGP application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare an EIS and conduct scoping (*Federal Register*, Volume 72, page 43296 [NRC 2007]) on August 3, 2007. The Staff visited the VEGP site and conducted a site audit in October 2007, and held two public scoping meetings on September 27, 2007. In the preparation of this draft supplemental environmental impact statement (SEIS) for VEGP, the Staff reviewed the VEGP Environmental Report and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process are provided in Appendix A, Part 1, of this draft SEIS.

The Staff plans to hold public meetings in Waynesboro, Georgia, in June 2008, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this draft SEIS. When the comment period ends, the Staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2 of the final SEIS.

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the Staff's preliminary recommendation regarding the proposed action.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers.

The evaluation criterion for the Staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine:

> . . . whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current operating licenses.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation–generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OPERATING LICENSE and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines.

The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS reached the following conclusions:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (that is SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the Staff relied on conclusions as amplified by supporting information in the GEIS for issues designated as Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized.

Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the Staff's consideration of all 92 environmental issues identified in the GEIS. The Staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the operating licenses for VEGP) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration (DOE/EIA), coal and gas-fired generation appear to be the most likely power-generation alternatives if the power from VEGP is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the VEGP site or some other unspecified alternate location.

SNC and the Staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither SNC nor the Staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the Staff has identified any new issue applicable to VEGP that has a significant environmental impact. Therefore, the Staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to VEGP.

VEGP's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The Staff has reviewed SNC's analysis for each issue and has conducted an independent review of each issue. Five Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at VEGP. Four Category 2 issues are not discussed in this draft SEIS, because they are specifically related to refurbishment. SNC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of VEGP for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Nuclear Regulatory Commission's 1985 *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2.*

Twelve Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. For all of the twelve Category 2 issues and environmental justice, the Staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. The Staff also determined that appropriate federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the Staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for VEGP and the plant improvements already made, the Staff concludes that SNC identified two potentially cost-beneficial SAMAs. However, these SAMAs do not relate to adequate managing of the effects of aging during the period of extended operation. Therefore, they do not need to be implemented as part of the license renewal pursuant to 10 CFR Part 54. Mitigation measures were considered for adverse effects associated with Category 2 issues. For these issues, current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of which agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, the Staff concluded that the cumulative impacts resulting from the incremental contribution of VEGP operation and maintenance of transmission line ROW would be SMALL for all resources.

If the VEGP operating license is not renewed and the unit ceases operation on or before the expiration of their current operating license, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of VEGP. The impacts may, in fact, be greater in some areas.

The preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for VEGP are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by SNC; (3) consultation with other Federal, State, and local agencies; (4) the Staff's own independent review; and (5) the Staff's consideration of public comments received during the scoping process.

Abbreviations/Acronyms

°	degree(s)
ac	acre(s)
AC	alternating current
ACC	averted cleanup and decontamination
ACEEE	American Council for an Energy Efficient Economy
ADAMS	Agency-wide Documents Access and Management System
AEO	*Annual Energy Outlook*
AFW	auxiliary feed water
ALARA	as low as reasonably achievable
ANS	Academy of Natural Sciences
AOC	averted off-site property damage costs
AOE	averted occupational exposure costs
AOSC	averted on-site costs
APE	averted public exposure
ASMFC	Atlantic States Marine Fisheries Commission
ATWS	anticipated transient without scram
BA	biological assessment
B.P.	Before Present
Bq	becquerel
BTU	British thermal unit(s)
C	Celsius
CAA	Clean Air Act
CCW	component cooling water
CDC	U.S. Centers for Disease Control and Prevention
CDF	core damage frequency
CET	Containment Event Tree
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic foot (feet) per second
cms	cubic meter(s) per second
cm/sec	centimeter(s) per second
Ci	curie(s)
CO	carbon monoxide
CO_2	carbon dioxide
COE	cost of enhancement
CPUE	catch-per-unit-effort
CSET	Containment Safeguards for Event Tree

CVCS	Chemical and Volume Control System
CWA	Clean Water Act
CWIS	Circulating Water Intake Structure
CWS	Circulating Water System
CWSH	Circulating Water Screenhouse
dBa	decibels
DBA	Design Base Accident
DAW	dry waste system
DC	direct current
DOE	U.S. Department of Energy
DSM	Demand Side Management
DWR	Division of Water Resources
EDG	emergency diesel generator
EFH	essential fish habitat
EGS	Enhanced Geothermal Systems
EIA	Energy Information Administration
EIS	environmental impact statement
EL	Environmental Laboratory
ELF-EMF	extremely low frequency-electromagnetic field
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERS	Environmental Radiation Surveillance
ESA	Endangered Species Act
ESP	early site permit
ESWS	Essential Service Water System
F	Fahrenheit
F&O	Facts and Observations
FES	Final Environmental Impact Statement
FIVE	fire-induced vulnerability evaluation
FMP	Fishery Management Plan
fps	foot (feet) per second
FPS	fire protection system
FR	*Federal Register*
FSAR	Final Safety Analysis Report
FSM	Fishery Management Plan
ft	foot (feet)
ft^3	cubic feet
ft/sec	feet per second
FWS	U.S. Fish and Wildlife Service

GDNR	Georgia Department of Natural Resources
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437*
GEPD	Georgia Environmental Protection Division
GL	Generic Letter
GPC	Georgia Power Company
gpm	gallon(s) per minute
GPSC	Georgia Public Service Commission
GWPS	gaseous radioactive waste processing system
ha	hectare(s)
HCLPF	high confidence of low probability of failure
HEPA	high efficiency particulate air
HNP	Edwin/Hatch Nuclear Plant
hr	hour(s)
HRA	Human Reliability Analysis
HVAC	heating, ventilation, and air conditioning
IGCC	Integrated Gusification Combined-Cycle
INEEL	Idaho National Energy and Environmental Laboratory
IPE	individual plant examination
IPEEE	individual plant examination of external events
IRP	Integrated Resource Plan
ISLOCA	Interfacing Systems Loss of Coolant Accidents
J	Joule
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
lb	Pound
LC_{50}	median lethal concentration
LERF	Large Early Release Frequency
LLMW	low-level mixed waste
LOCA	loss of coolant accident
LOS	level of service
LPSI	low pressure safety injection
LWPS	liquid waste processing system

m	meter(s)
m/s	meter(s) per second
mm	millimeter(s)
m^3	cubic meter(s)
mA	milliampere(s)
MAAP	Modular Accident Analysis Program
MACCS2	MELLCOR Accident Consequence Code System 2
MBq	megabequerel
MCL	maximum contaminant level
MDC	Minimal Detectable Concentration
MDS	Minimum Desirable Streamflow
mg	milligram(s)
mgd	million gallons per day
mGy	milligray(s)
mg/L	milligram(s) per liter
mi	mile(s)
mL	milliliter(s)
MMACR	Modified Maximum Averted Cost-Risk
MOX	mixed oxide
mph	miles per hour
mrad	milliard(s)
mrem	millirem(s)
m/s	meter(s) per second
msl	mean sea level
MSW	Municipal Solid Waste
mSv	millisievert
MT	metric ton
MTHM	metric tonne
MTU	metric ton of uranium
MUSH	Makeup Water Screen House
MW	megawatt(s)
MWd	megawatt-days
MW(e)	megawatt(s) electric
MWh	megawatt hour(s)
MW(t)	megawatt(s) thermal
MWSF	Mixed Waste Storage Facility
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NCP	normal charging pump
NEPA	National Environmental Policy Act of 1969, as amended

NESC	National Electric Safety Code
NETL	National Energy Technology Laboratory
ng	Nanograms
NGVD	national geodetic vertical datum
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_x	nitrogen oxide(s)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSCW	Nuclear Service Cooling Water
O3	ozone
ODCM	Offsite Dose Calculation Manual
O&G	oil and grease
PAH	polycyclic aromatic hydrocarbon
PAM	primary amoebic meningoencephalitis
PAYS	Pay as You Save
Pb	lead
pCi/L	picoCuries per liter
pCi/kg	picoCuries per kilogram
$PM_{2.5}$	particulate matter, 2.5 microns or less in diameter
PM_{10}	particulate matter, 10 microns or less in diameter
ppm	parts per million
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment
PWR	pressurized water reactor
radwaste	radioactive waste
RAI	request for additional information
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Environmental Monitoring Program
rkm	river kilometer(s)
RLE	review level earthquake
RM	river mile(s)
ROI	region of influence
ROW	right-of-way

RPC	long-term replacement power costs
RRW	risk reduction worth
RWDS	radioactive waste disposal system
RWST	refueling water storage tank
s	second(s)
SAR	Safety Analysis Report
SAMA	severe accident mitigation alternative
SBO	station blackout
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas
SCR	selective catalytic reduction
SDWIS	Safe Drinking Water Information System
sec	second
SECPOP	sector population, land fraction and economic estimation program
SEIS	supplemental environmental impact statement
SER	Safety Evaluation Report
SGTR	Steam Generator Tube Ruptures
SHPO	State Historic Preservation Office
SNC	Southern Nuclear Operating Company, Inc.
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SOP	standard operating procedure(s)
SRS	Savannah River Site
SSE	safe shutdown earthquake
Sv	sievert
SWMS	solid waste management system
SWS	Service Water System
TD	turbine driven
TDS	total dissolved solids
TL	total length
TLD	thermoluminescent dosimeters
TMDL	Total Maximum Daily Load
TRC	Third Rock Consultants
TSS	total suspended solids
UHS	ultimate heat sink
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USD	Unified School District

USGS	U.S. Geological Survey
V	volt(s)
VEGP	Vogtle Electric Generating Plant Units 1 and 2
VOC	volatile organic compound
WET	whole effluent toxicity
WHC	Wildlife Habitat Council
WINGS	Wildlife Incentives for Non-Game and Game Species
WMA	Wildlife Management Area
WOG	Westinghouse Owner's Group
YOY	young of year
yr	year(s)

1.0 Introduction

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51, which implement the National Environmental Policy Act of 1969, as amended (NEPA), renewal of a nuclear power plant operating license requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment, and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the Staff prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that need to be addressed by the applicants in plant-by-plant renewal proceedings. Use of the GEIS guides the preparation of complete plant-specific information in support of the operating license renewal process.

Southern Nuclear Operating Company, Inc. (SNC) operates Vogtle Electric Generating Plant Units 1 and 2 (VEGP) near Waynesboro, Georgia under Operating License NPF-68 for Unit 1 and NPF-81 for Unit 2, which were issued by the NRC. The operating license will expire on January 16, 2027 for Unit 1 and February 9, 2029 for Unit 2. The Unit 2 license will not expire within the 20-year period designated in the License Renewal Rule; therefore, SNC filed for and received exemption by letter from the NRC dated January 9, 2007 (NRC 2007a) that supports the early renewal of the Unit 2 license.

On June 27, 2007, SNC submitted an application to the NRC to renew the SNC operating licenses for an additional 20 years under 10 CFR Part 54 (SNC 2007a). SNC is a licensee for the purposes of its current operating license and an applicant for the renewal of the operating license. Pursuant to 10 CFR 54.23 and 51.53(c), SNC submitted an Environmental Report (Environmental Report; SNC 2007b) in which SNC analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

This report is the draft facility-specific supplement to the GEIS (the supplemental EIS [SEIS]) for the SNC license renewal application. This draft SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The Staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this draft SEIS, including the development of the GEIS and the process used by the Staff to assess the environmental impacts associated with license renewal, (2) describe the proposed Federal action to renew the VEGP operating license, (3) discuss the purpose and need for the proposed action, and (4) present the status of SNC's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The ensuing chapters of this draft SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and the irreversible or irretrievable commitment of resources. Chapter 9 also presents the Staff's preliminary recommendation with respect to the proposed license renewal action.

Additional information is included in appendices. Appendix A contains public comments related to the environmental review for license renewal and Staff responses to those comments. Appendices B through G, respectively, include the following:

- The preparers of the supplement (Appendix B),

- The chronology of the NRC staff's environmental review correspondence related to this draft SEIS (Appendix C),

- The organizations contacted during the development of this draft SEIS (Appendix D),

- SNC's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process) (Appendix E),

- GEIS environmental issues that are not applicable to VEGP (Appendix F), and

- NRC staff evaluation of severe accident mitigation alternatives (SAMAs) (Appendix G).

1.2 Background

Use of the GEIS, which examines the possible environmental impacts that could occur as a result of renewing individual nuclear power plant operating licenses under 10 CFR Part 54, and the established license renewal evaluation process support the thorough evaluation of the impacts of operating license renewal.

1.2.1 Generic Environmental Impact Statement

The NRC initiated a generic assessment of the environmental impacts associated with the license renewal term to improve the efficiency of the license renewal process by documenting the assessment results and codifying the results in the Commission's regulations. This assessment is provided in the GEIS, which serves as the principal reference for all nuclear power plant license renewal EISs.

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse effects, (5) determines whether the results of the analysis apply to all plants, and (6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significantly" which requires consideration of both "context" and "intensity" (40 CFR 1508.27). Using the CEQ terminology, the NRC established three significance levels – SMALL, MODERATE, or LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as follows:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this draft SEIS unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria of Category 1; therefore, additional plant-specific review for these issues is required.

In the GEIS, the Staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The two issues not categorized are environmental justice and chronic effects of electromagnetic fields. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

An applicant seeking to renew its operating license is required to submit an Environmental Report as part of its application. The license renewal evaluation process involves careful review of the applicant's Environmental Report and assurance that all new and potentially significant information not already addressed in or available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

In accordance with 10 CFR 51.53(c)(2) and (3), the Environmental Report submitted by the applicant must:

- Provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B in accordance with 10 CFR 51.53(c)(3)(ii) and

- Discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

In accordance with 10 CFR 51.53(c)(2), the Environmental Report does not need to:

- Consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered or (2) relevant to mitigation,

- Consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives,

- Discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b), or

- Contain an analysis of any Category 1 issue unless there is significant new information on a specific issue — this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its application to renew the VEGP operating license, SNC developed a process to ensure that (1) information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for VEGP would be properly reviewed before submitting the Environmental Report and (2) such new and potentially significant information related to renewal of the license for VEGP would be identified, reviewed, and assessed during the period of NRC review. SNC reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to VEGP. This review was performed by personnel from SNC and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal Environmental Report.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, NUREG-1555, Supplement 1 (NRC 2000). The search for new information includes: (1) review of an applicant's Environmental Report and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the Staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are applicable to VEGP. At the beginning of the discussion of each set of issues, there is a table that identifies the issues to be addressed and lists the sections in the GEIS where the issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For Category 1 issues for which there is no new and significant information, the table is followed by a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, followed by the Staff's analysis and conclusion. For Category 2 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the draft SEIS sections where the analysis is presented. The draft SEIS sections that discuss the Category 2 issues are presented immediately following the table.

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the SNC license renewal application began with the publication of a notice of acceptance for docketing, notice of opportunity for a hearing, and notice of intent to prepare an EIS and conduct scoping in the Federal Register (FR; 72FR43296; NRC 2007b) on August 3, 2007. A public scoping meeting was held on September 27, 2007 in Waynesboro, Georgia. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Vogtle Electric Generating Plant* (NRC 2007c). Comments are presented in Part 1 of Appendix A of this draft SEIS.

The Staff followed the review guidance contained in NUREG-1555, Supplement 1 (NRC 2000). The Staff and contractor retained to assist the Staff visited the SNC Site on October 15 through 17, 2007, to gather information and to become familiar with the site and its environs. The Staff also reviewed the comments received during scoping, and consulted with federal, state, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to VEGP were reviewed and are referenced within this draft SEIS.

This draft SEIS presents the Staff's analysis that considers and weighs the environmental effects of the proposed renewal of the operating license for VEGP, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental effects. Chapter 9, "Summary and Conclusions," provides the NRC staff's preliminary recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff's review. During this comment period, public meetings will be held in Waynesboro, Georgia. During these meetings, the Staff will describe the preliminary results of the NRC environmental review and answer questions related to it to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the operating license for VEGP. The VEGP facility is located approximately 15 miles east-northeast of Waynesboro, Georgia and 26 miles southeast of Augusta, Georgia. The VEGP Nuclear Steam Supply System consists of two Westinghouse pressurized water reactors (PWRs) and a reactor core power of 3565 megawatts-thermal (MWt), and an approximate net electrical output of 1232 megawatts-electrical (MWe) for each unit. A power uprate for Vogtle Units 1 and 2 is in process and set for submittal to the NRC in 2007 (SNC 2007b). VEGP has a cooling tower–based heat dissipation system. Plant cooling is provided by four forced-draft mechanical cooling towers with underground reservoirs drawing from groundwater wells. Makeup water is drawn from and blowdown is discharged to the Savannah River.

The current operating licenses for VEGP expire on January 16, 2027 for Unit 1 and February 9, 2029. The Unit 2 license will not expire within the 20-year period designated in the License Renewal Rule; therefore, SNC filed for and received exemption by letter from the NRC dated January 9, 2007 (Docket No. 50-425; NRC 2007a) that supports the early renewal of the Unit 2 license. By letter dated June 27, 2007, SNC submitted an application to the NRC (SNC 2007a) to renew this operating license for an additional 20 years of operation (i.e., January 16, 2047 for Unit 1 and February 9, 2049 for Unit 2).

1.4 The Purpose and Need for the Proposed Action

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing operating license, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an operating license is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (GEIS Section 1.3):

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decision makers.

This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954, as amended or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of state regulators and utility officials as to whether a particular nuclear power plant should continue to operate. From the perspective of the licensee and the state regulatory authority, the purpose of renewing an operating license is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's license.

1.5 Compliance and Consultations

SNC is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its Environmental Report, SNC provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with VEGP license renewal. Authorizations and consultations relevant to the proposed operating license renewal action are included in Appendix E.

The Staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The Environmental Report states that SNC is in compliance with applicable environmental standards and requirements for VEGP. The Staff has not identified any environmental issues that are both new and significant.

1.6 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

Atomic Energy Act of 1954. 42 USC 2011, et. seq.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et. seq.

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, *"Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2007a. Letter from Mr. Robert E. Martin, NRC, Washington, DC, to Mr. D. E. Grissette regarding Vogtle Electric Generating Plant, Unit 2, Exception from the Requirements of 10 CFR part 54, Section 54.17(a) Regarding Schedule for License Renewal Application (TAC No. MD2116), January 9, 2007.

Nuclear Regulatory Commission (NRC). 2007b. "Notice of Receipt and Availability of Application for Renewal of Vogtle Electric Generating Plant, Units 1 and 2 Facility Operating Licenses Nos. NPF-68 and NPF-81, for an Additional Twenty-Year Period." *Federal Register* Volume 72, p. 43296. August 3, 2007.

Nuclear Regulatory Commission (NRC). 2007c. *Environmental Impact Statement Scoping Process: Summary Report – Vogtle Electric Generating Plant.* Washington, DC.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *License Renewal Application, Vogtle Electric Generating Plant, Docket Numbers 50-424 and 50-425, Facility Operating License Numbers NPF-68 and NPF-81.*

Southern Nuclear Operating Company, Inc. (SNC). 2007b. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant. Docket Numbers 50-424 and 50-425.*

2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

Vogtle Electric Generating Plant (VEGP) is located in Burke County, Georgia. The facility consists of two Westinghouse pressurized water reactors (PWR) producing steam that turns a turbine to generate electricity. Facility cooling is provided by a Nuclear Service Cooling Water (NSCW) system, which consists of two forced-draft mechanical cooling towers. The plant and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

2.1 Facility and Site Description and Proposed Plant Operation During the Renewal Term

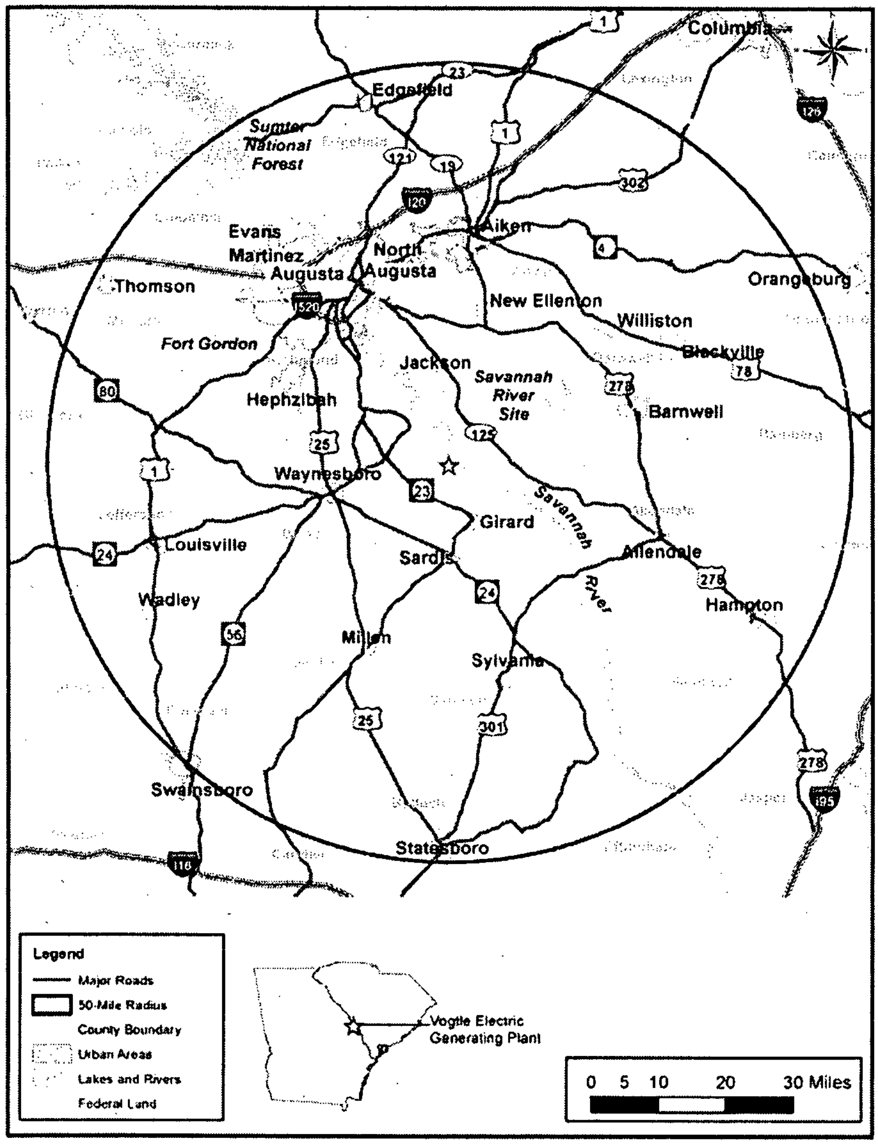
VEGP is a 3169-acre (ac) site located in a rural area on former forest and agricultural land. Ownership of VEGP is shared by the following based on the ownership percentages shown: Georgia Power Company (GPC) (45.7 percent), Oglethorpe Power Corporation (30 percent), Municipal Electric Authority of Georgia (22.7 percent), and City of Dalton, Georgia (1.6 percent). Dalton is a municipality that is doing business by and through the Water, Light, and Sinking Fund Board of Commissioners as Dalton Utilities. GPC is owned by the Southern Company. Southern Nuclear Operating Company (SNC) is a subsidiary of the Southern Company and is the U.S. Nuclear Regulatory Commission (NRC) licensee for VEGP (SNC 2007a).

VEGP is located on a Coastal Plain bluff on the southwest side of the Savannah River. The nearest cities are Waynesboro, Georgia approximately 15 miles west-southwest and Augusta, Georgia approximately 26 miles northwest. The site is bounded by River Road, Hancock Landing Road, and approximately 1.7 miles of the Savannah River (River Miles [RM] 150.0 to 151.7). The topography consists of low rolling hills with elevations ranging from 200 to 280 feet (ft) above mean sea level (msl; SNC 2007a). The site location and features within a 50-miles (mi) and 6-mi radii are illustrated on Figures 2-1 and 2-2, respectively.

The following features are located within a 6-mi radius of the VEGP site:

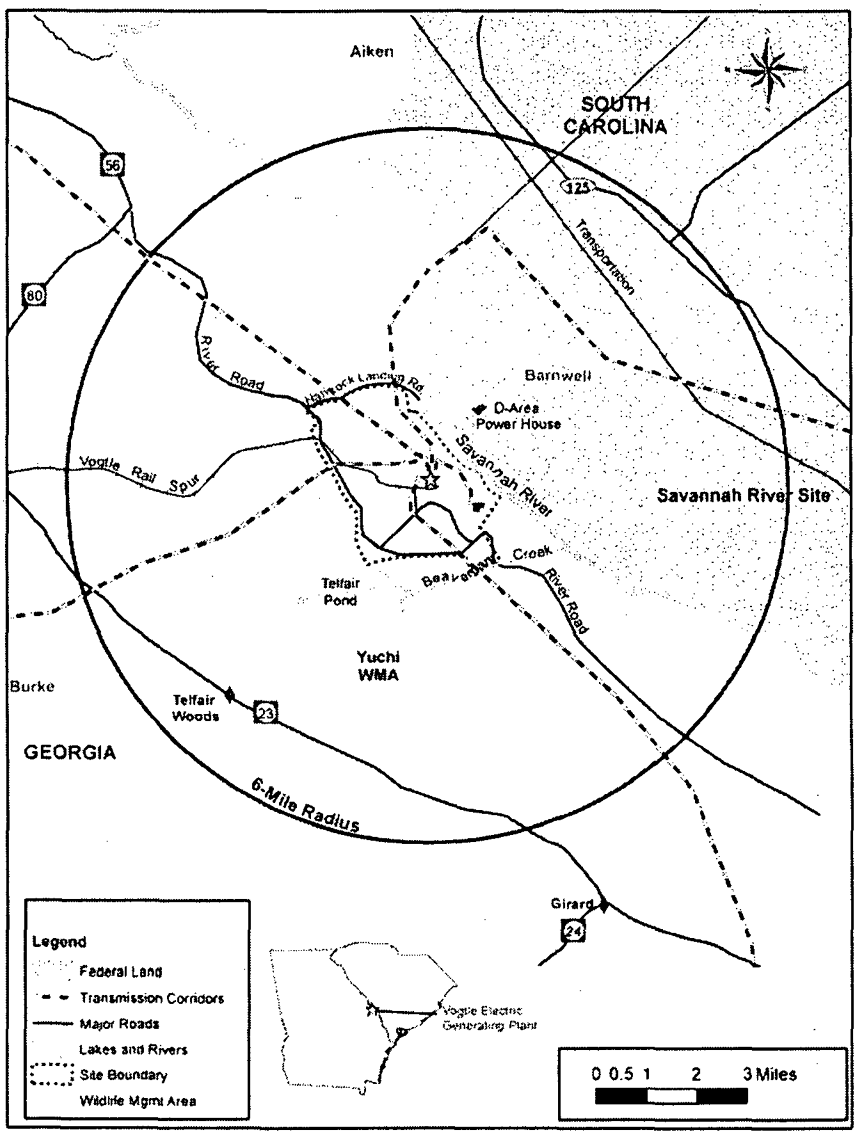
- Telfair Woods, a crossroads community approximately 5 miles southwest of VEGP;
- Yuchi Wildlife Management Area, a 7,000 acre site adjacent to VEGP to the south; and
- Savannah River Site (SRS), a Department of Energy (DOE) facility located directly across the Savannah River from VEGP.

The SRS is a DOE-operated, Federally owned facility that covers a total area of 310 square miles. Its development began in 1950. Five nuclear reactors and two processing facilities for the production of materials for nuclear weapons, as well as other facilities, were built on SRS,



Source: SNC 2007a

Figure 2-1. Location of VEGP, 50-Mi Radius



Source: SNC 2007a

Figure 2-2. Location of VEGP, 6-Mi Radius and construction was completed in 1955. The SRS reactors utilized once-through cooling systems that used water from the Savannah River, and the heated water was discharged to tributaries of the river (Reed et al. 2002). Within the 6-mile radius of VEGP, features at SRS include two remediated industrial areas, one fossil fuel power plant (the D-Area Power House), and three inactive recessed intake structures located on the east side of the Savannah River (SNC 2007b). Past operations at SRS have resulted in the release of radiological and hazardous contaminants, including tritium, to the atmosphere, groundwater, and surface water (SNC 2007b).

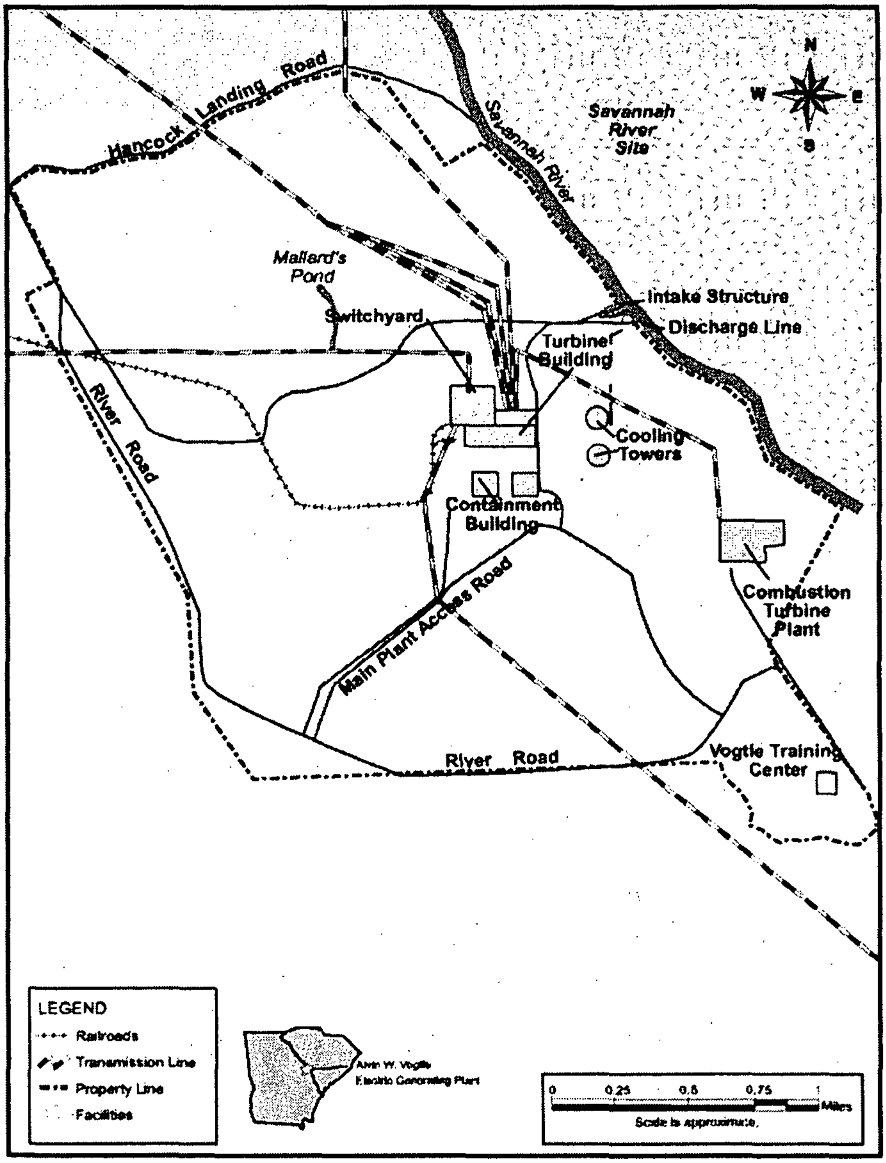
Although SRS is not specifically associated with the proposed relicensing of VEGP, the close proximity of SRS to VEGP and the types of operations conducted at SRS are relevant to this SEIS for two reasons: past industrial and radiological operations at SRS may have affected environmental resources in the vicinity of VEGP, and environmental studies associated with SRS are the source of much of the data and information utilized in Chapter 2 of the SEIS. Baseline environmental studies of the SRS area and the Savannah River began in 1951 prior to construction. Subsequently, numerous studies have been and continue to be conducted to assess the environmental impacts of SRS operations. All SRS nuclear reactors were shut down by 1989, though other nuclear-related operations, research and development, environmental remediation, and ecological studies at the facility are ongoing (Reed et al. 2002).

2.1.1 Site Location and Features

VEGP is located on the Savannah River (RM 150.0 to 151.7). The facility can be accessed by U.S. Route 25; Georgia Routes 46, 80, 24, or 23; and River Road (Figure 2-2).

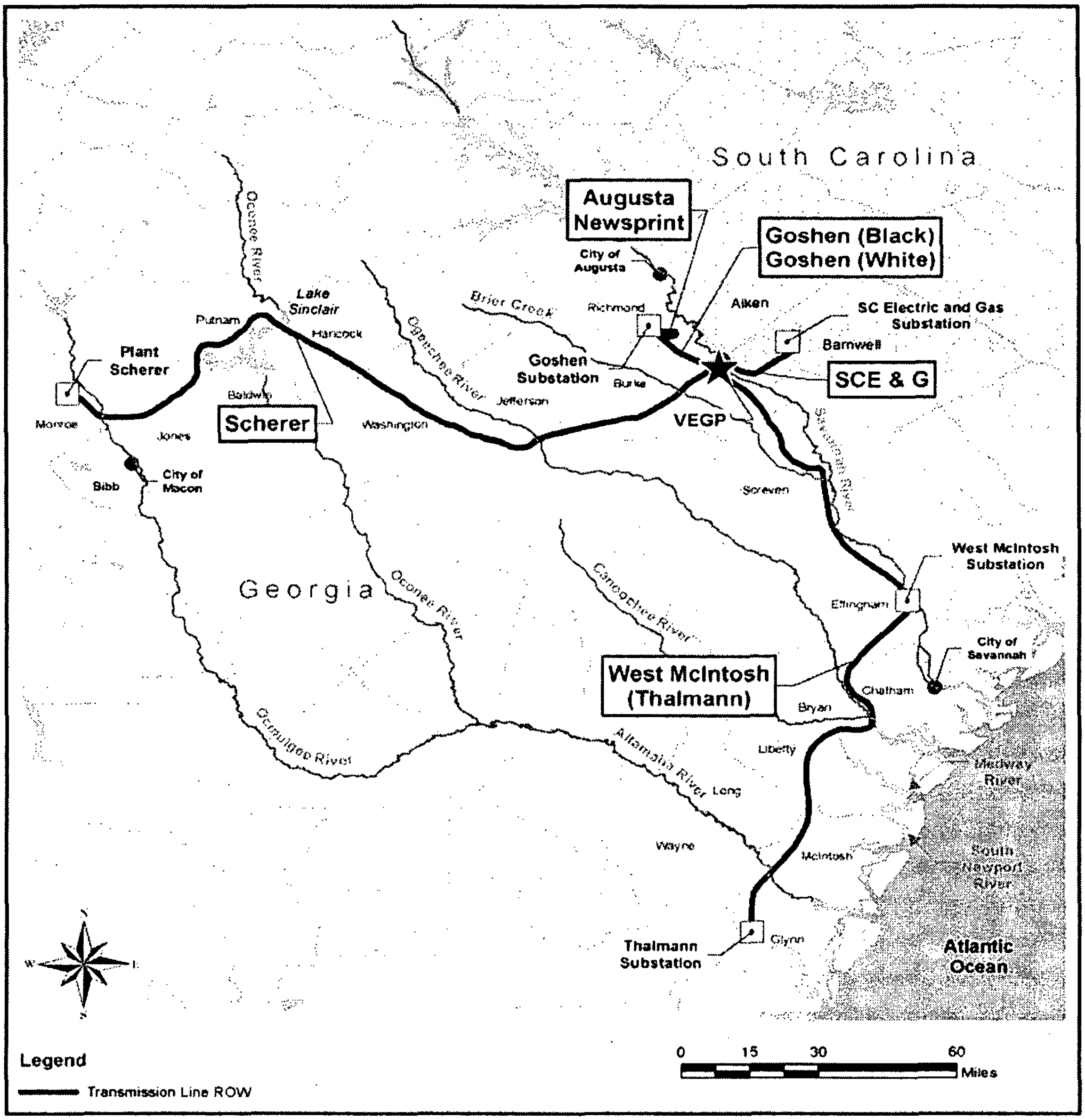
The major features of the 3169-ac VEGP site are the reactor containment building, turbine building, auxiliary building, combustion turbine plant, cooling towers, switchyard, and the training center (SNC 2007a). The nearest residence is located approximately 1.6 kilometer (km; 1 mile) from the facility (SNC 2007b). The closest communities are Telfair Woods (a crossroads community), located approximately 5 miles southwest of the facility and Girard (population 230), located approximately 8 miles to the south (SNC 2007a). The property boundary and general facility layout are depicted on Figure 2-3.

VEGP has two 500-kilovolt (kV) transmission lines and five 230-kV lines contained within five right-of-ways (ROWs; Figure 2-4). The two 500-kV lines are the Scherer and the Thalmann lines. The Scherer line runs west from VEGP to Plant Scherer in Macon, Georgia. The associated ROW is approximately 154 miles long and generally 150 feet wide. The Thalmann line runs south to West McIntosh substation north of Savannah, Georgia. The associated ROW is approximately 159 miles long and 150 feet wide. Three of the 230-kV lines run north from the VEGP site. Two lines run approximately 19 miles to the Goshen substation in a 275 feet wide



Source: SNC 2007a

Figure 2-3. VEGP Property Boundaries and Facility Layout



Adapted from: SNC 2007a and ESRI 2002

Figure 2-4. VEGP Transmission Lines and Water Bodies

ROW. A third lines runs 17 miles in the South Augusta ROW and then branches off for approximately 3 miles to the Augusta Newsprint substation in a 275 foot wide ROW. One 230-kV line runs through the South Carolina Electric and Gas (SCE&G) ROW. This ROW runs north and east for 4.5 miles, crosses the Savannah River, and runs 17 miles to a substation operated by SCE&G on the SRS. The ROW is 125 foot wide in Georgia and 100 foot wide in South Carolina. The fifth 230-kV line is the Wilson Line, which is located wholly on VEGP property, connects VEGP to Plant Wilson, and is used in the event of an emergency. The associated ROW is 150 foot wide (SNC 2007a).

2.1.2 Reactor Systems

VEGP is a nuclear-powered steam electric generating facility that began commercial operation in May 1987 (Southern Company 2007). The two nuclear reactors are Westinghouse PWRs producing a reactor core power of 3565 megawatts-thermal per unit. The design net electrical capacity is 1232 megawatts-electric per unit (SNC 2007a).

For each unit, the nuclear steam supply system at VEGP is a four-loop Westinghouse pressurized water reactor. The steam yields its energy to turn the turbines, which are connected to the electrical generator. The nuclear fuel is low-enriched uranium dioxide with enrichments of 5 percent by weight uranium-235 or less and fuel burnup levels of a batch average of approximately 60,000 megawatt-days per metric ton uranium. VEGP operates on an 18-month refueling cycle. The reactor, steam generators, and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. The containment building is a vertical, right-cylindrical, pre-stressed, post-tensioned concrete structure with a dome and flat base with a depressed center for a reactor cavity and instrumentation tunnel. A carbon steel liner is attached to the inside face of the concrete shell to insure a high degree of leak tightness. In addition, the approximately 4-ft thick concrete walls serve as a radiation shield for both normal and accident conditions (SNC 2007a).

2.1.3 Cooling and Auxiliary Water Systems

VEGP operates several water systems, including systems to provide cooling for the reactor to remove waste heat from the condensors (circulating water system); and to serve a variety of other purposes (SNC 2007a, USACE 1996). The source of water for the circulating water system is the Savannah River, while the source for all other systems is onsite groundwater wells (SNC 2007a, USACE 1996).

2.1.3.1 Circulating Water System

The circulating water system at VEGP is part of a closed-cycle heat dissipation system that utilizes water withdrawal from intakes on the Savannah River and natural draft cooling towers (SNC 2007a). The intake system consists of a 365-ft long intake canal located on the western bank of the river (SNC 2007a). The earthen bottom of the river at the discharge is 67 feet above msl. There is a skimmer weir at the entrance to the intake canal, and a canal weir 100 feet inside the entrance. A sedimentation basin between the two weirs is used to allow silt to settle out before entering the plant. The purpose of the skimmer weir is to prevent floating materials from entering the intake canal (SNC 2007a).

The intake structure at the head of the canal contains four bays (two for each unit), each with a stop log, trash rack, traveling screens, and a single pump (SNC 2007a). The trash racks consist of a series of vertical flat bars, and the traveling screens are annealed type 304 stainless steel ¾ inch mesh (SNC 2007a). As the system operates, wash water is used to rinse the traveling screen and drive debris into a debris basket, which is emptied periodically (SNC 2007a). Daily inspections are performed, and fish or other aquatic organisms are rarely observed (SNC 2007a).

Using an average river flow rate of 10,300 cubic feet per second (cfs) and water elevation of 85 feet above msl, the Final Environmental Statement (FES) for the facility operations determined that flow velocities across the trash rack would be 0.3 feet per second, and velocities across the screens would be 0.7 feet per second (NRC 1985). The FES concluded that these velocities would be low enough so that fish entering the intake canal could escape the screens by swimming away (NRC 1985).

The circulating water is removed from the intake by vertical turbine pumps, each with a capacity of 22,000 gallons per minute (gpm) (SNC 2007a). The circulating water is directed into the natural draft cooling towers, which use natural convection to remove heat from water that has been used to cool the condensers (SNC 2007a). Because the cooling towers operate as a closed-system, the only water loss is through evaporation, drift, and blowdown (SNC 2007a).

To minimize fouling within the cooling towers and condensers, the circulating water is treated with sodium hypochlorite and sodium bromide (SNC 2007a). To treat the oxidation products from these chemicals, the water is also treated with ammonium bisulfite in the blowdown mixing sump prior to discharge of blowdown (SNC 2007a). Potential contaminants with the blowdown are regulated by the facility's National Pollutant Discharge Elimination System (NPDES) permit, which is described in Section 2.2.3.1.

The cooling tower blowdown and other liquid wastestreams (such as the liquid radioactive waste treatment effluents) are discharged back to the Savannah River through a discharge structure located 500 feet downstream of the intake structure (SNC 2007a). The discharge consists of a buried pipe which is 2 feet in diameter, and oriented in order to minimize bottom scour (SNC 2007a).

2.1.3.2 Nuclear Service Cooling Water System

The source of water for the Nuclear Service Cooling Water (NSCW) system is groundwater production wells located on the VEGP property (SNC 2007a). A description of these wells, and their uses, is provided in Section 2.2.2.1.2. The water within this system is circulated through four forced-draft mechanical cooling towers with underground reservoirs, which act as the ultimate heat sink for the facility (SNC 2007a). Blowdown from this system is combined with the cooling tower blowdown from the circulating water system and liquid radioactive waste treatment effluent, and discharged to the Savannah River through the same discharge structure (SNC 2007a). As with the circulating water, the discharge of the NSCW system blowdown is monitored and regulated in accordance with the VEGP NPDES permit (SNC 2007a).

2.1.3.3 Other Water Systems

In addition to cooling water, VEGP uses water for a variety of miscellaneous purposes, including makeup water for the wastewater treatment plant, fire protection systems, potable water supply, sanitary water, pure water systems, and irrigation for landscaping (SNC 2007a). The source of water for all of these uses is from groundwater production wells, which are discussed in more detail in Section 2.2.2.1.2. The ultimate discharge of all of these systems is through the Savannah River discharge location, which is regulated by the VEGP NPDES permit (SNC 2007a).

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

VEGP radioactive waste disposal systems (RWDS) provide controlled handling and disposal of radioactive wastes. All equipment in the RWDS is controlled from the waste processing system panel. Operating procedures for the RWDS ensure that radioactive wastes are safely processed and discharged from the plant to ensure compliance with the dose limits contained in Title 10 of the Code of Federal Regulations (CFR) Part 20; the dose design objectives of Appendix I to 10 CFR Part 50, Numerical Guide for Design Objectives and Limiting Conditions for Operation to Meet the Criterion “As Low As is Reasonably Achievable” for Radiological Material in Light-Water-Cooled Nuclear Power Reactor Effluents; the plant's technical specifications; and VEGP's *Offsite Dose Calculation Manual* (ODCM) (SNC 2003a).

Unless otherwise noted, the description of the radioactive wastes management systems is based on information provided in the applicant's Environmental Report (SNC 2007a) or the

VEGP Final Safety Analysis Report (FSAR)(SNC 2006a), and the Staff's independent review of NRC Inspection Reports.

VEGP's RWDS are designed to collect, treat, and dispose of the radioactive wastes that are byproducts of plant operations. The byproducts are activation products resulting from the irradiation of reactor water and impurities therein (principally metallic corrosion products) and fission products resulting from migration through the fuel cladding or uranium contamination within the reactor coolant system. Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid. Liquid radioactive wastes are generated from liquids received directly from portions of the reactor coolant system or were contaminated by contact with liquids from the reactor coolant system. Gaseous radioactive wastes are generated from gases or airborne particulates vented from the reactor. Solid radioactive wastes are solids from the reactor coolant system or solids that came into contact with reactor coolant system's liquids or gases (SNC 2006a).

Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh fuel assemblies during routine refueling outages, typically every 18 months. The spent fuel assemblies are stored in the spent fuel pool in the reactor building. VEGP also provides for on-site storage of mixed wastes, which contain both radioactive and chemically hazardous materials (SNC 2006a).

VEGP's ODCM contains the methodology and parameters used to calculate off-site doses resulting from radioactive gaseous and liquid effluents, and the radiation monitoring alarm and trip set points used to verify that the radioactive material being discharged meets regulatory limits (SNC 2003a). The ODCM also contains the radioactive effluent controls and radiological environmental monitoring program requirements and the information that is required to be included in the annual Radiological Environmental Operating Report and annual Radioactive Effluent Release Report required by Appendix I to 10 CFR Part 50, and 10 CFR 50.36a, respectively.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The VEGP liquid waste processing system (LWPS) collects, holds, treats, processes, and monitors all liquid radioactive wastes for reuse or disposal. The LWPS is divided into several subsystems so that liquid wastes from various sources can be segregated and processed separately. Cross connections between the subsystems provide additional flexibility for processing the wastes by alternate methods. The wastes are collected, treated, and disposed of according to their conductivity and/or radioactivity (SNC 2006a).

Liquid wastes are collected in sumps and drain tanks and transferred to the appropriate subsystem collection tanks for subsequent treatment, disposal, or recycle. Liquid wastes are processed by a series of components and employing various processes specifically designed to provide maximum decontamination factors. The processing methods used include; filtration, reverse osmosis, and/or demineralization. Following treatment, the processed wastes in the waste evaporator condensate tank, waste monitor tanks, or secondary liquid waste monitor tanks are analyzed for chemical and radioactive content prior to being discharged. In addition, the LWPS can handle effluent streams that typically do not contain radioactive material, but that may, on occasion, become radioactive (e.g., steam generator blowdown as a result of steam generator tube leakage). Any planned releases from the system are evaluated in conjunction with all other radioactive liquid releases to ensure that the total release does not exceed the ODCM limits. The liquid effluent normally discharges from the plant into the cooling water system, which dilutes the effluent and transports it to the Savannah River. Liquid releases to the Savannah River are controlled and limited to satisfy the dose objectives of Appendix I to10 CFR Part 50.

The NRC staff reviewed the VEGP radioactive effluent release reports for 2002 through 2006 for liquid effluents (SNC 2003a, 2004a, 2005a, 2006b, 2007b). There were no unplanned releases from either unit in 2006. The amount of radioactivity discharged in liquid releases, excluding gases, tritium, and alpha, totaled 9.02 E-02 curies (Ci) (3.33 E+03 megabequerel [MBq]), from the VEPG site in 2006. A total of 2.00 E+03 Ci (7.40 E+07 MBq) of tritium were released from the VEPG site in 2006. A total of 1.48 E-03 Ci (5.47 E+01 MBq) of dissolved and entrained gases from the VEPG site in 2006. There were no releases of gross alpha radioactivity from the VEPG site in 2006 (SNC 2007b). The liquid discharges for 2006 are consistent with the radioactive liquid effluents discharged from 2002 through 2005. Variations on the amount of radioactive effluents released from year to year are expected based on the overall performance of the plant and the number and scope of outages. The liquid radioactive wastes reported by VEPG are reasonable and no unusual trends were noted. Based on the applicant's assertion that there are no refurbishment activities planned, similar quantities of radioactive liquid effluents are expected from VEPG during the license renewal term.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The gaseous radioactive waste processing system (GWPS) and the plant ventilation exhaust system control, collect, process, store, and dispose of gaseous radioactive wastes generated as a result of normal operation. The GWPS consists mainly of two closed loops comprised of a waste gas compressor, a catalytic hydrogen recombiner, and seven gas waste gas decay tanks to accumulate the fission product gases. All pipes containing radioactive gases are shielded as necessary, and no piping is run through normally occupied areas. Gaseous effluents at VEGP are currently discharged through the following locations or systems: Unit 1 and Unit 2 plant vents (which includes discharges from containment purge system, gaseous radioactive waste system, fuel handling building heating, ventilation, and air conditioning (HVAC), and auxiliary building HVAC), the condenser air ejector, Unit 1 and Unit 2 steam packing exhauster systems, Radwaste Processing Facility, and the Dry Active Waste Building. The primary source of the radioactive gas to the GWPS is the volume control tank purge. Smaller quantities of radioactive gas are received via the vent connections from the reactor coolant drain tank, the pressurizer relief tank, and the recycle holdup tanks. The operation of the GWPS reduces the fission gas concentration in the reactor coolant system which, in turn, reduces the release of fission gases from the reactor coolant system during maintenance operations or through equipment leakage (SNC 2006a).

Gaseous wastes are collected in the vent header. These gases are withdrawn from the vent header by one of the two compressors and sent to the waste gas decay tanks. The gases are monitored and pass through a pre-filter, high efficiency particulate filter, charcoal filter, and another high efficiency particulate filter in series which reduce the amount of particulate radioactive material to very low levels. Although the system is designed to accommodate continuous operation without atmospheric releases, the VEGP GWPS design permits controlled discharges of gas from the system to the atmosphere. Before a waste gas decay tank is released to the atmosphere through the plant vent, the gas must be analyzed to determine and document the amount of radioactivity being released. When the contents of the tank are being released to the atmosphere, a trip valve in the discharge line will close automatically if activity above a predetermined level is detected by the plant vent radiation monitor (SNC 2006a).

VEGP maintains radioactive gaseous effluents in accordance with the procedures and methodology described in the ODCM. The GWPS is used to reduce radioactive materials in gaseous effluents before discharge to meet the ALARA dose objectives in Appendix I to10 CFR Part 50 (SNC 2007b).

The NRC staff reviewed the VEGP radioactive effluent release reports for 2002 through 2006 for gaseous effluents (SNC 2003a, 2004a, 2005a, 2006b, 2007b). There were five (5) unplanned releases from the VEGP site in 2006. Analysis by the applicant's staff showed that none of the unplanned releases exceeded regulatory dose limits. The amount of radioactivity discharged in form of fission and activation gaseous from the VEPG site in 2006, totaled 2.95 Ci (1.09 E+05 MBq). A total of 81.5 Ci (3.01 E+06 MBq) of tritium were released from the VEPG site in 2006. A total of 2.55 E-07 Ci (9.43 E-03 MBq) of radioiodines and 7.68 E-05 Ci (2.84 MBq) of particulates were released from the VEPG site in 2006 (SNC 2007b). The gaseous discharges for 2006 are consistent with the radioactive gaseous effluents discharged from 2003 through 2005. Variations on the amount of radioactive effluents released from year to year are expected based on the overall performance of the plant and the number and scope of outages. The gaseous radioactive wastes reported by VEPG are reasonable and no unusual trends were noted.

Based on the applicant's assertion that there are no refurbishment activities planned, similar quantities of radioactive gaseous effluents are expected from VEPG during the license renewal term.

2.1.4.3 Solid Waste Management System

The solid waste management system (SWMS) is designed to collect, process, and package low-level radioactive wastes generated as a result of normal plant operation. The SWMS is designed and operated in a manner to keep radiation exposure to plant personnel as low as reasonably achievable (ALARA). The SWMS equipment is located in the radioactive waste processing facility and the dry active waste (DAW) facility. The DAW facility is also capable of storing the packaged waste until it is shipped off-site to a waste processor for treatment and/or disposal or directly to a licensed burial site. Transportation and disposal of solid radioactive wastes are performed in accordance with the requirements of 10 CFR Part 71 and 10 CFR Part 61, respectively. To minimize worker's radiation exposure, access to the process equipment and solid radioactive waste storage areas is controlled by barriers such as locked doors, gates, or control cards.

The SWMS consists of a wet process stream used to collect, process, dewater, and solidify wet solid wastes, and a dry process stream used to collect and package dry solid wastes. Wet solid wastes include spent resins, filter cartridges, and filter crud. Dry solid wastes include contaminated rags, clothing, paper, outage equipment, and other radioactively contaminated equipment (SNC 2006a).

In 2006, VEGP made a total of 31 shipments of solid waste. The class A, B, and C, solid non-compacted waste volume was 96.60 cubic meters (3.41 E+03 cubic feet) of dry compressible waste and contaminated equipment, with an activity of 3.37 E+02 Ci (1.24 E+07 MBq) (SNC 2007b). Volume reduction of the waste prior to final disposal is performed by a contractor at an off-site location. No shipments of spent resins, irradiated fuel, or irradiated components were made in 2006. The solid waste volumes and radioactivity amounts generated in 2006 are typical of annual waste shipments made by VEGP. Variations on the amount of solid radioactive waste generated and shipped from year to year are expected based on the overall performance of the plant and the number and scope of maintenance work and outages. The volume and activity of solid radioactive waste reported by VEPG are reasonable and no unusual trends were noted. Based on the applicant's assertion that there are no refurbishment activities planned, similar quantities of radioactive solid radioactive wastes are expected from VEPG during the license renewal term.

The State of South Carolina's licensed low-level radioactive waste disposal facility, located in Barnwell, SC, may limit access after June, 2008 from radioactive waste generators located in states that are not part of the Atlantic Low-Level Waste Compact. This may impact VEGP's ability to dispose of its low-level solid radioactive waste. However, VEGP is aware of this situation and is developing several design concepts to provide for on-site low-level radioactive waste storage. One design concept being considered is to use a shielded storage pad with individual compartments for the placement of high integrity containers containing radioactive wastes. The shielding is designed to ensure that the off site dose does not exceed any of the Federal limits specified in 10 CFR Part 20, as well as the EPA's radiation standards in 40 CFR Part 190 (SNC 2007d).

2.1.5 Nonradioactive Waste Systems

VEGP generates solid, hazardous, universal, and mixed waste from routine facility operations and maintenance activities.

2.1.5.1 Nonradioactive Waste Streams

VEGP generates solid waste, as defined by the Resource Conservation and Recovery Act (RCRA), as part of routine plant maintenance, cleaning activities, and plant operations. These solid waste streams include non-radioactive resins and sludges, putrescible wastes, recyclable wastes, and concrete, bricks, and rubble. The non-radioactive resins and sludge are disposed of offsite in a permitted industrial landfill, with a total volume of six roll-off containers disposed in 2006. Putrescible wastes also are disposed offsite in a permitted landfill (SNC 2006c). Materials that are collected for local recycling include paper, aluminum cans, scrap metal (300 tons per year), used oil, and antifreeze (SNC 2006c). Construction materials such as concrete, bricks, and rubble are disposed onsite in a facility called the Private Industrial Landfill, which is permitted by the Georgia Department of Natural Resources (GDNR; SNC 2006c).

Hazardous waste is nonradioactive waste that is listed by the EPA as hazardous waste or that exhibits characteristics of ignitability, corrosivity, reactivity, or toxicity (40 CFR Part 261). RCRA regulates the treatment, storage, and/or disposal of hazardous waste and requires a hazardous waste permit for facilities that treat or store large quantities of hazardous waste for more than 90 days and for entities that dispose of hazardous waste at the facility. RCRA regulations are administered in Georgia by the GDNR, Georgia Environmental Protection Division (GEPD). VGEP is a small quantity generator, but manages wastes in a manner consistent with the regulatory requirements for large quantity generators (SNC 2006c). In both 2006 and 2007, VEGP disposed of a total of approximately 600 pounds of RCRA hazardous waste.

Universal waste is hazardous waste that has been specified as universal waste by the EPA. Universal waste, including mercury-containing equipment, batteries, lamps, and pesticides, has specific regulations (40 CFR Part 273) to ensure proper collection and recycling or treatment. VGEP generates batteries, capacitors, and fluorescent light bulbs as universal wastes from normal facility operations. These wastes are accumulated in satellite areas and then shipped off-site for disposal in accordance with universal waste regulations. On an annual basis, VEGP generates an average of 18 drums of light bulbs, 28 drums of capacitors, and 50 pallets of batteries (SNC 2006c).

Low-level mixed waste (LLMW) is waste that exhibits hazardous characteristics and contains low levels of radioactivity. LLMW has been regulated under multiple authorities. EPA or State agencies regulate the hazardous component of LLMW through RCRA and the NRC regulates the radioactive component. VGEP generates LLMW from routine maintenance, refueling outages, health protection activities, and from operations in the radiochemical laboratory. The facility generates small volumes of LLMW, and maintains procedures for safe management, storage, and offsite disposal (SNC 2006c).

The VEGP facility has two sanitary treatment systems which operate under a NPDES permit. These systems generate sludge as a solid waste. The sludge is disposed of offsite through the Burke County wastewater treatment facility (SNC 2006c).

2.1.5.2 Pollution Prevention and Waste Minimization

Currently, VEGP has a Waste Minimization Plan designed to reduce the amount and toxicity of waste generated and disposed of in a landfill (SNC 2006c). The plan includes procedures for evaluating and reducing the generation of the following types of wastes: oily rags and resins; light bulbs; batteries and capacitors; asbestos; and used oil.

2.1.6 Facility Operation and Maintenance

Maintenance activities conducted at VGEP include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs and activities currently exist at VGEP to maintain, inspect, test, and monitor the performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel in-service inspection and testing, maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those implemented to meet technical specification surveillance requirements, those implemented in response to the NRC generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages. SNC refuels VGEP on an 18 month fueling cycle (SNC 2007a).

2.1.7 Power Transmission System

VEGP is currently connected to the electric power grid via two 500-kV and five 230-kV transmission lines, all of which are owned, operated, and maintained by SNC (SNC 2007a). The FES for the operation of the VEGP site (NRC 1985) discusses the seven transmission lines intended to connect the VEGP site with the regional transmission grid. Transmission lines considered in scope for license renewal are those constructed to connect the facility to the transmission system (10 CFR 51.53(c)(3)(ii)(H)); a discussion of the seven in scope transmission lines follows. The characteristics of these lines and their ROWs are summarized in Table 2-1. Figure 2-4 is a map of the transmission system.

- Scherer Line – The 500-kV line is 154 miles (248 km) long and runs generally westward from the VEGP site to Plant Scherer, which is located north of Macon, Georgia. It crosses portions of Burke, Jefferson, Washington, Hancock, Putnam, Baldwin, Jones, and Monroe Counties. The Scherer Line ROW is 150 feet (46 meters [m]) wide for the majority of its length, but occasionally has a width of 400 feet (122 m). The ROW crosses terrain that is mainly flat to rolling (SNC 2007a).

- West McIntosh (Thalmann) Line – The 500-kV line is 159 miles (256 km) long and runs from the VEGP site to a substation near Brunswick. The line first runs south from VEGP for 69 miles (111 km) to the West McIntosh substation near Savannah. It then continues south for an additional 90 miles (145 km) to its termination at the Thalmann substation, near Brunswick. The line has a 150 foot (46 m) wide ROW. The terrain traversed by the ROW is gently rolling to flat and includes many low, wet areas (TRC 2006; SNC 2007a).

- Goshen (Black) and Goshen (White) Line – The two 230-kV Goshen lines run approximately 19 miles (31 km) northwest from the VEGP site to the Goshen substation south of Augusta. The line has a 275 foot (84 m) wide ROW. The two Goshen lines, plus 17 miles (27 km) of the Augusta Newsprint line, described below, share the ROW. The ROW crosses terrain that is generally flat (SNC 2007a).

- Augusta Newsprint Line – The 230-kV line runs approximately 20 miles (32 km) from the VEGP site to the Augusta Newsprint substation where it serves a large paper mill located in southeast Richmond County. The Augusta Newsprint and Goshen lines share a 275 foot (84 m) wide ROW until the Augusta Newsprint line diverges east from the two Goshen lines at mile 17 (km 27). The ROW of the Augusta Newsprint line is 100 to 125 feet (30 to 38 m) wide for the remaining 3 miles (5 km). The terrain traversed by the ROW is generally flat (SNC 2007a).

Table 2-1. VEGP Transmission Lines and ROWs

Transmission Line	Voltage	Approximate Line Length		ROW Width		ROW Area	
	kV	km	mi	m	ft	hectares	ac
Scherer	500	248	154	46	150	1,133	2,800
West McIntosh (Thalmann)	500	257	160	46	150	1,177	2,909
Goshen (Black)	230	31	19	84	275	140	346
Goshen (White)	230	31	19	Shared with Black		Shared with Black	
Augusta Newsprint	230	27	17	Shared with Goshen		Shared with Goshen	
	230	5	3	38	125	18	45
SCE&G	230	7.2	4.5	38	125	28	68
	230	27	17	30	100	83	206
Wilson	230	2.3	1.4	46	150	10	25
Totals		636	395			2,585	6,395

Adapted from: SNC 2007a

- SCE&G Line – The 230-kV line runs north and east from the VEGP site for 4.5 miles (7.2 km) where it crosses the Savannah River, then runs an additional 17 miles (27 km) to a substation on SRS, which is maintained and managed by SCE&G. The line has a 125 foot (38 m) wide ROW within Georgia and a 100 foot (30 m) wide ROW within South Carolina. The part of the line and its ROW in South Carolina is entirely within the SRS. The ROW crosses terrain that is mostly flat (SNC 2007a).

- Wilson Line – The 230-kV line runs southeast from the VEGP switchyard for 1.4 miles (2.3 km) to Plant Wilson. The line and ROW are entirely on VEGP property and maintain a 150 foot (46 m) wide ROW. The ROW crosses terrain that is mostly flat. The Wilson line would provide offsite power to the VEGP site in the event of an emergency (SNC 2007a).

SNC owns and operates 395 miles (636 km) of transmission lines and maintains 6395 acres (2585 hectacres [ha]) of ROW associated with the transmission lines. The ROWs are generally on agricultural land and forests, and occasionally cross swamps and wetlands. Much of the farmland the ROWs cross is currently active. The Oconee National Forest is crossed by the Scherer line northeast of Plant Scherer. Additionally, the West McIntosh (Thalmann) line crosses three significant natural areas: the Yuchi Wildlife Management Area, which is adjacent to the VEGP site, the Tuckahoe Wildlife Management Area, which is approximately 30 miles (48 km) south of the VEGP site, and one privately owned swamp, the Ebenezer Creek Swamp, which is designated as a National Natural Landmark and is crossed by the line near the West McIntosh plant (SNC 2007a).

SNC maintains the ROW for all seven transmission lines, in accordance with established procedures, to prevent vegetation from interfering with the lines (GPC 1997). The vegetative maintenance program includes selected backpack spraying of approved herbicides on dry ground and stream crossings every other year; in non-spraying years, SNC follows a four-year mowing cycle (SNC 2007a; TRC 2006). If danger trees are identified at any time during the maintenance cycle, they are trimmed and sprayed as needed. On wetland areas, no herbicides are used, the area is not mowed, and only hand clearing is allowed. ROWs that cross farmland are not maintained, as the land is cultivated by the local farmers. The transmission lines were built in conjunction with the construction of the plant in the mid-1980s and in accordance with the National Electrical Safety Code (NESC). SNC plans to maintain these ROWs whether or not VEGP has its license renewed, and has stated that the transmission lines play a role in the overall transmission system (SNC 2007a).

2.2 Plant Interaction with the Environment

2.2.1 Land Use

The VEGP facility occupies a 3169-ac site. The two nuclear units (Units 1 and 2 including containment and turbine buildings, as well as shared auxiliary, control, and fuel handing buildings), two natural draft cooling towers, supporting facilities such as service water cooling towers, a water treatment building, switchyard, and training center, parking lots, roads, transmission ROWs, and Plant Wilson occupy approximately 800 acres. The undeveloped portion of the site includes approximately 1634 acres of pine forest, 612 acres of hardwood forest, and 96 acres of open areas including mowed grass (NRC 2007). The forested acreage is covered by a land management plan developed to ensure effective management of timber and wildlife resources (SNC 2007a). Figure 2-3 depicts the VEGP property boundary and general facility layout.

VEGP is located in and pays property taxes to Burke County. Burke County guides land use by means of a comprehensive plan and land development code, but does not currently have zoning regulations.

Seven transmission lines with a total length of approximately 395 miles connect the VEGP facility to the electric power grid. These transmission lines are described in detail in Section 2.1.7. The transmission line ROWs, which occupy approximately 6395 acres, traverse primarily agricultural and forest lands. The primary land use classifications traversed by the ROWs are: Scherer line – agricultural 29 percent, forest 63 percent; West McIntosh (Thalmann) – agricultural 32 percent, forest 29 percent for VEGP to West McIntosh substation, and agricultural 5 percent, forest 68 percent for West McIntosh substation to Thalmann substation; Goshen/Augusta Newsprint – agricultural 14 percent, forest 75 percent; SCE&G – agricultural 4 percent, forest 69 percent (SNC 2007a).

Section 307(c)(3)(A) of the Coastal Zone Management Act (16 USC 1456(c)(3)(A)) requires that applicants for Federal licenses to conduct an activity in a coastal zone provide to the licensing agency a certification that the proposed activity is consistent with the enforceable policies of the State's coastal zone program. A copy of the certification is also to be provided to the State. Within six months of receipt of the certification, the State is to notify the Federal agency whether the State concurs with or objects to the applicant's certification. The VEGP site is not located in a coastal zone. However, one transmission line, the West McIntosh (Thalmann) line, runs through several coastal counties. This line is within Georgia's coastal zone for purposes of the Coastal Zone Management Act.

SNC's certification that renewal of the VEGP license would be consistent with the Georgia coastal zone management program will be provided to GDNR concurrent with NRC issuing this draft SEIS (SNC 2007a).

2.2.2 Water Use

2.2.2.1 Hydrology

This section describes the surface water and groundwater features of the area that could be impacted by the proposed relicensing of VEGP.

2.2.2.1.1 Surface Water

The VEGP facility is located on the southern bank of the Savannah River, which serves as the border between Georgia and South Carolina. VEGP uses water from the river to provide make-up water to the facility's cooling tower system. The Savannah River watershed is approximately 10,579 square miles. The upstream end of the Savannah River is the confluence of the Seneca and Tugaloo Rivers, which is a part of Hartwell Lake (USACE 1996). The Savannah River flows 288.9 miles from the Hartwell Dam to the Atlantic Ocean at the mouth of the river in Savannah, Georgia. The facility is located at RM 151, directly across the river from the DOE's SRS (SNC 2006c).

Flow in the Savannah River is primarily controlled by releases from three upstream dams and reservoirs operated by the U.S. Army Corps of Engineers (USACE), including the Hartwell Dam (RM 288.9), Richard B. Russell Dam (RM 259.1), and J. Strom Thurmond Dam (RM 221.6). Between the J. Strom Thurmond Dam and the VEGP site are the Stevens Creek Dam (RM 208.1), the city of Augusta (approximately RM 200), the New Savannah Bluff Lock and Dam

(RM 187.7), and the mouths of several small creeks (SNC 2006d). The factor most directly affecting river flow rates at RM 151 is the releases from J. Strom Thurmond Reservoir, which is located 72 miles upstream of the VEGP facility (SNC 2006c). The annual mean flow volume of the Savannah River near Augusta from 1952 to 2004 was 9157 cfs (Gotvald et al. 2005).

The Savannah River adjacent to the VEGP site is relatively straight with very few bends. The substrate in the deep sections of the Savannah River ranges from "brown poorly graded gravel with sand" to "poorly graded gravel" (SNC 2006d).

Channel modifications have been made to the Savannah River to allow for a 9-ft deep by 90-ft wide navigation channel from the Savannah Harbor to the city of Augusta. Maintenance of the channel was discontinued in 1980; therefore, discharges from J. Strom Thurmond Dam are based on the needs of downstream water supply withdrawals without concern for navigation (USACE 2006). U.S. Geological Survey (USGS) flow gage 02197320 is located near Jackson, South Carolina, approximately 6 miles upstream of the VEGP site at Savannah (RM 156.8) (USGS 2002).

Water releases from the J. Strom Thurmond Dam are governed by the USACE's Drought Contingency Plan for the Savannah River, which requires releases of a minimum of 3800 cfs to the Savannah River to maintain flows for downstream water users, unless the reservoir's level falls below the bottom of the conservation pool, which is at an elevation of 312 feet above msl (USACE 2007a). If the water level in the reservoir falls below 312 feet above msl, then the Drought Contingency Plan requires that releases be made at the same flow rate as inflows to the reservoir (USACE 2007a). The minimum flow of 3800 cfs is based on Georgia's instream flow guidelines for the Savannah River, established by the GEPD for the regulation of surface water withdrawals. The instream flow guidelines were established in 2006 and are based on the 7Q10 value (SNC 2007b), which is the lowest average stream flow expected to occur for seven consecutive days with an average frequency of once in ten years (UGA Carl Vinson Institute of Government 2006).

Long-term daily flow records for the Savannah River at Augusta, recent flow records for the Savannah River at VEGP (a site referred to as "Savannah River near Waynesboro"), release rates from the J. Strom Thurmond Dam, and lake levels in J. Strom Thurmond Reservoir were reviewed to estimate average and low-flow conditions in the Savannah River. A review of the USACE data for J. Strom Thurmond Dam shows that the level of the reservoir has never fallen below 312 feet above msl since operation of VEGP began in 1987 (USACE 2007b). However, releases of flows less than 3800 cfs are not uncommon and occurred on 76 separate days between October 2006 and October 2007 (USACE 2007c). Instream flow data for the Savannah River near the Waynesboro station at VEGP are available only since 2005. However, these limited data show that the flow rate near the VEGP facility has not dropped below 3900 cfs even though this portion of Georgia is currently considered to be in a state of severe hydrologic drought (USGS 2007a and USGS 2007b). Reviews of the available USGS stream flow data for the Savannah River at Augusta (22 miles upstream of VEGP; USGS 2007c) indicate that actual flows of less than 3800 cfs are rare. Since 1987, the lowest annual average stream flow recorded in the Savannah River at Augusta was 4470 cfs in 2002 (USGS 2007d).

The following water temperature statistics were generated for the period from January 30, 1973, to August 13, 1996: minimum = 5.0°C (41.0°F), average = 17.4°C (63.4°F), median = 18.0°C (64.4°F), and maximum = 27.2°C (81.0°F) (SNC 2006d). Savannah River water temperature data were collected by the GDNR at Shell Bluff Landing, approximately 11 RM upstream of the VEGP site.

2.2.2.1.2 Groundwater

The VEGP facility exists within the Coastal Plain Physiographic Province. At the facility location, the subsurface geology consists of more than 1000 feet of Coastal Plain sediments overlying Triassic Basin rock and Paleozoic crystalline rock. Within these rock units, three distinct hydrogeologic aquifers underlie the facility: the Cretaceous aquifer, Tertiary aquifer, and Water Table aquifer.

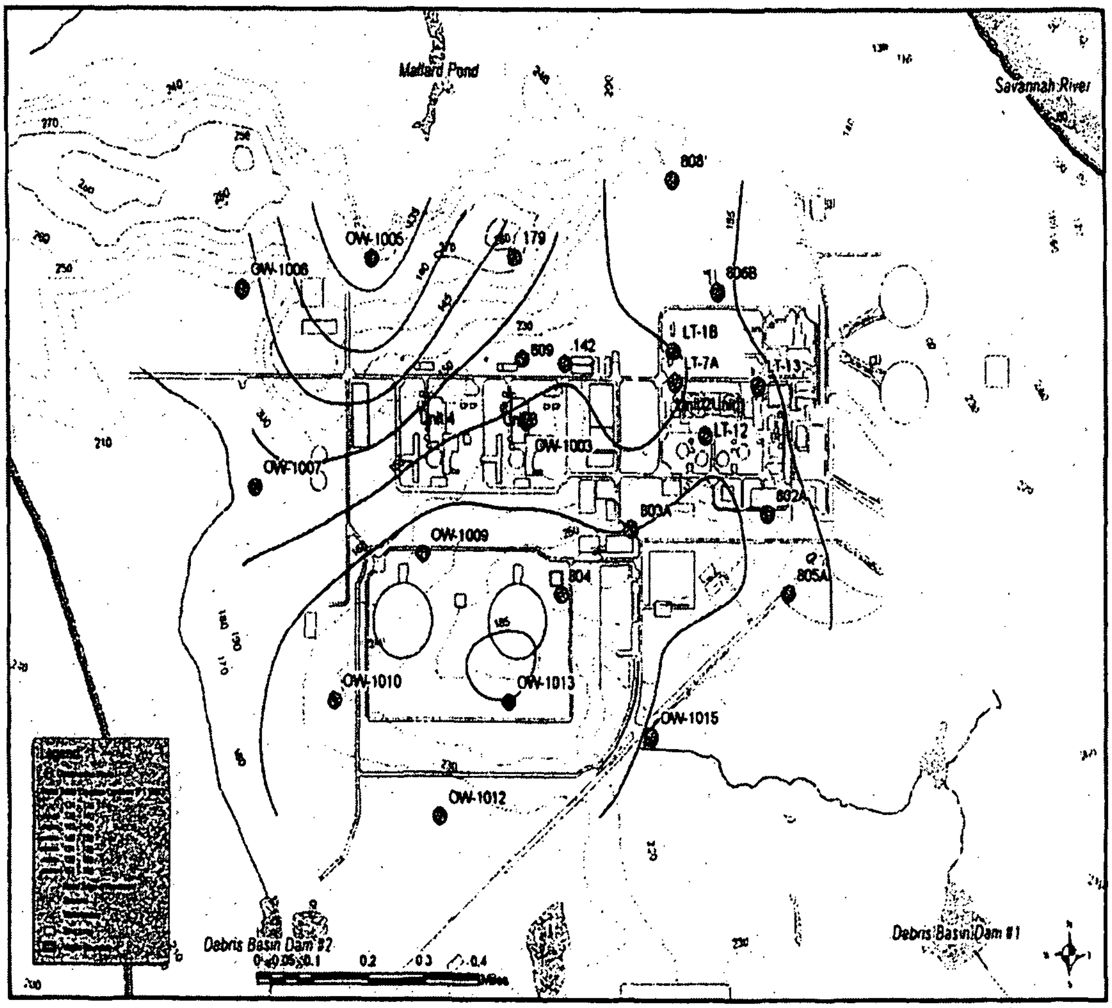
The lower aquifer is the Cretaceous aquifer, which is approximately 700 feet thick at the facility (SNC 2007a). The Cretaceous aquifer consists of sediments of the Cape Fear Formation, Pio-Nono Formation, Galliard Formation, Black Creek Formation, and Steel Creek Formation (SNC 2007a). The Cretaceous aquifer is a good water source, and is capable of producing up to 5 billion gallons per day throughout its extent (SNC 2005b). The Cretaceous aquifer is the primary aquifer, in the local region, from which municipal and industrial water supplies are derived. A review of the registered groundwater users within 50 miles of the VEGP site shows that the majority of permitted wells (124 out of 171) derive their water supply from the Cretaceous aquifer (SNC 2006c). The largest user of groundwater in the local area is the SRS, which withdraws water from the Cretaceous aquifer at a rate of 5000 gpm (SNC 2007a). According to the facility's Updated UFSAR (SNC 2005b), the withdrawals at the SRS do not have an impact on groundwater conditions at VEGP.

The Cretaceous aquifer is overlain by the Tertiary aquifer, which consists of permeable sands of the Still Branch and Congaree Formations, and is approximately 100 feet thick (SNC 2006c). Groundwater recharge in both aquifers occurs through rainfall in the area where the aquifers crop out, northwest of the VEGP site. At the VEGP site, both the Cretaceous and Tertiary aquifers are overlain and confined by the Blue Bluff marl, but they are in hydraulic contact with each other. Further downdip, to the south, the Cretaceous and Tertiary aquifers become separated by impermeable silts and clays of the Huber and Ellenton Formations (SNC 2006c). The regional flow direction in both aquifers is to the southeast, in the direction of dip.

The Water Table aquifer is unconfined, and is present within sands of the Barnwell Group. Although present at the VEGP site, it is not continuous throughout the area, and does not provide a substantial groundwater source in the local area (SNC 2006c).

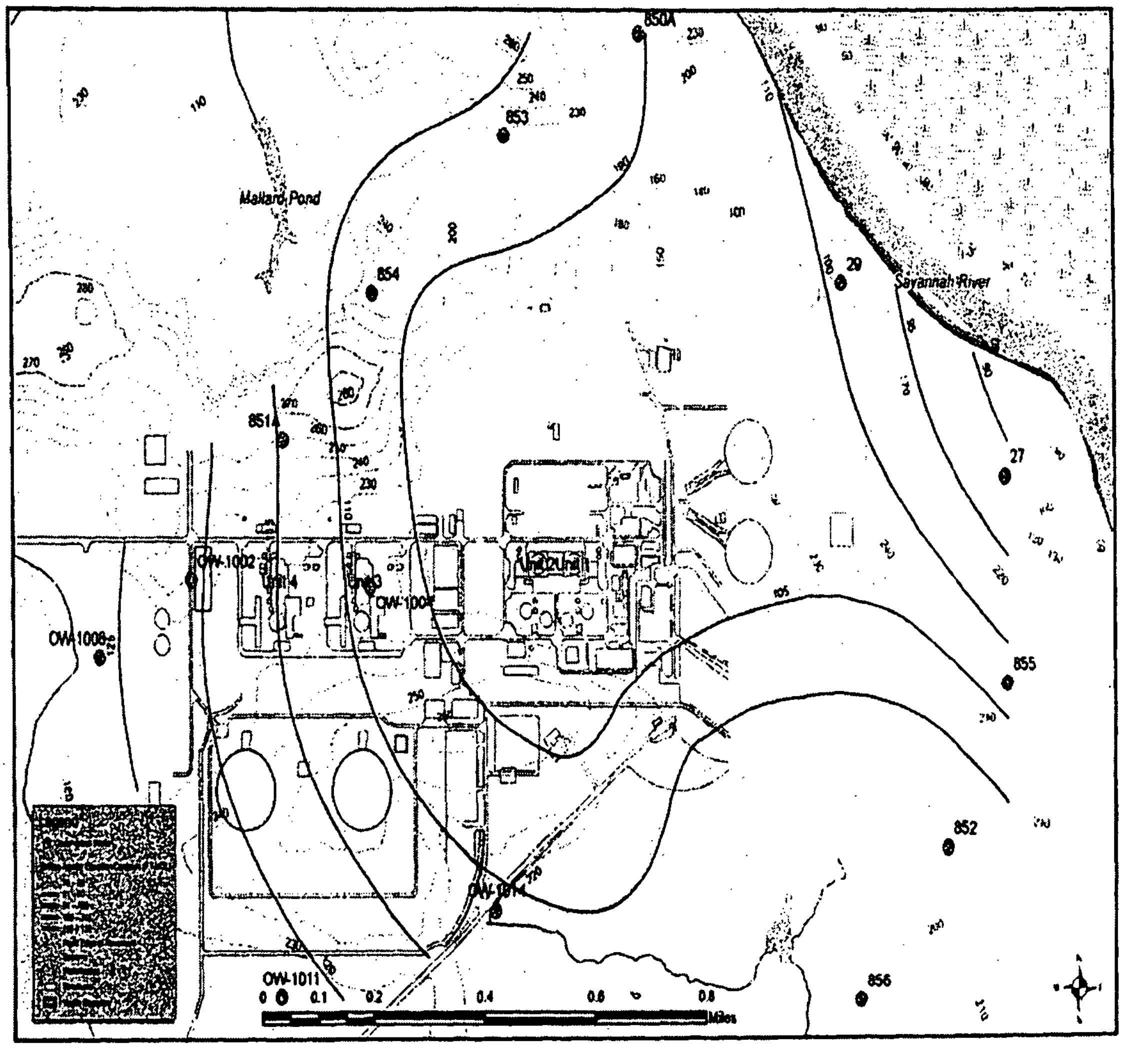
Hydraulic monitoring data has been collected in both the Water Table aquifer and Tertiary aquifer by VEGP. Beginning in 1979, water levels were measured in observation wells in the Water Table aquifer to monitor dewatering associated with plant construction. Water levels were measured monthly in these wells through 1988, then quarterly from 1995 to 2005, and then monthly again (with 10 newly installed observation wells) from 2005 to present. Water levels were also monitored in two wells in the Tertiary aquifer from 1971 to 1975, and 1979 to 1985. Five new observation wells were installed in the Tertiary aquifer in 2005, and their water levels have been monitored monthly since that time. No observation wells exist in the Cretaceous aquifer, which is separated from the Tertiary aquifer by a leaky confining unit. The 15 new observation wells installed in 2005 were installed for the purpose of collecting groundwater flow direction data to support the proposed construction of two additional units at VEGP (SNC 2006c).

The hydraulic monitoring data for the Water Table aquifer shows that the flow direction on the VEGP site is radial, apparently driven by the topography of the site. The potentiometric surface, shown in Figure 2-5, has a high that is coincident with the highest land surface elevation on the site, and the groundwater flow direction is to the north, east, south, and west of this high (SNC 2006c). The potentiometric surface for the Tertiary aquifer, shown in Figure 2-6, shows that the flow direction is to the northeast, in the direction of the Savannah River. This is in contrast to the general regional flow direction, which is southeast, and reflects the fact that the Savannah River has eroded down through the Blue Bluff marl and indicates that there is a potential for discharge from the Tertiary aquifer to the Savannah River in the area of the VEGP facility. Pre-operational and post-operational groundwater levels were measured in the Water Table Aquifer from 1979 to 1988, and again from 1995 to present (SNC 2006c). Groundwater levels were also measured in Tertiary Aquifer wells from 1971 to 1985, and again from 2005 to present (SNC 2006c). A review of the potentiometric surface in the area near withdrawal well MU-1 indicates a lowering of groundwater levels by about 15 feet between 1971 and 2006. However, water levels in nearby observation wells (such as well 27 and 29) do not appear to indicate any long-term trend, such as gradually falling water levels, that may indicate that facility operations are having a widespread impact on groundwater resources.



Source: SNC 2006c

Figure 2-5. Potentiometric Map – Water Table Aquifer



Source: SNC 2006c

Figure 2-6. Potentiometric Map – Tertiary Aquifer

2.2.2.2 Facility Water Use

For facility operations, VEGP uses both surface water and groundwater resources to supply the cooling water and auxiliary water systems, as well as potable water supply and other miscellaneous water systems.

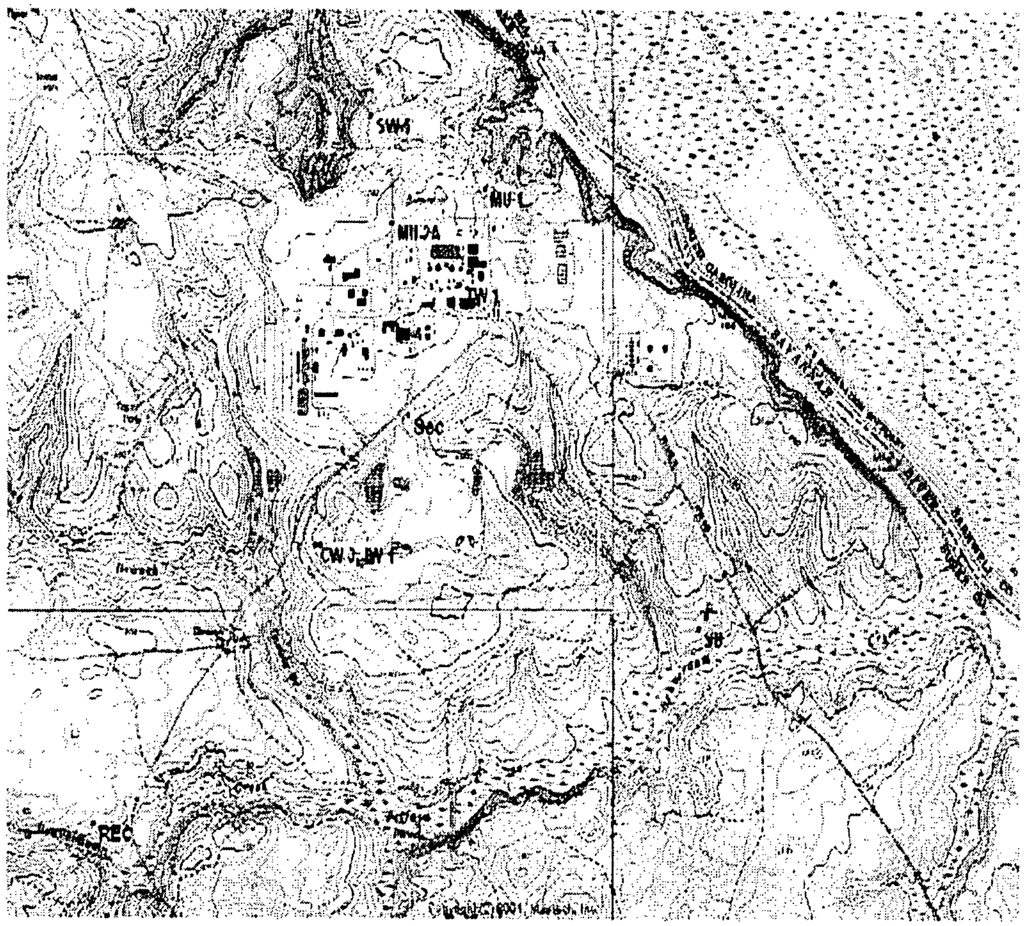
2.2.2.2.1 Surface Water

The cooling water system is the CWS, a closed-cycle system used for removing waste heat from the steam condensers associated with the power generation system (SNC 2007a). The CWS is supplied by a surface water intake which acquires water from the Savannah River. The water is obtained through a 365-ft long intake canal, and placed into a closed-loop system in which the water is heated at the steam condensers, and cooled in two natural draft cooling towers. To avoid buildup of minerals within the cooling tower water, blowdown water is discharged, along with liquid radioactive waste treatment effluents, through a pipe located approximately 500 feet downstream of the intake canal (SNC 2007a).

Although a closed system, the system does lose water through evaporative loses, drift, and blowdown, resulting in net usage of water from the Savannah River (SNC 2007a). The VEGP ER reports that the capacity of the intake system is 89 cfs (SNC 2007a), of which an estimated 66.8 cfs (about 75 percent) is consumed through evaporative losses and drift (NRC 1985). In 2006, the actual reported maximum monthly average for water withdrawal was 103.8 cfs (SNC 2007e). Using the same 75 percent consumption ratio, the maximum monthly average consumptive use in 2006 was 77.9 cfs for the entire facility.

2.2.2.2.2 Groundwater

Groundwater is used by the facility to supply the Nuclear Service Cooling Water (NSCW) system, demineralized water treatment plant, potable water, utility water, and fire protection water (SNC 2007f). The groundwater supply source is a network of nine wells. The location of the wells is shown in Figure 2-7, and details regarding the construction and capacity of the wells are provided in Table 2-2. The groundwater wells are permitted under a single withdrawal permit (Groundwater Use Permit #017-0003) from the GEPD (SNC 2007f). The total permitted annual average withdrawal volume for all purposes is 5.5 million gallons per day (mgd), while the actual annual average withdrawal volume since 2000 is 1.05 mgd (SNC 2007a).



Source: SNC 2006c

Figure 2-7. Location of Groundwater Supply Wells

2.2.3 Water Quality

2.2.3.1 Surface Water

Contaminant concentrations in the aquatic environment at VEGP are monitored on an ongoing basis by personnel of the Georgia Power Company (GPC) Environmental Laboratory (EL), the South Carolina Department of Health and Environmental Control (SCDHEC), the GDNR, and the SRS. These organizations operate sampling programs to evaluate any potential impacts of facility operations on surface water, sediment, and aquatic life. Samples collected to monitor for potential releases of radionucllides to surface water include surface water samples, drinking water samples, shoreline sediment samples, and fish tissue samples. Sample collection and analytical frequencies vary depending on the exposure pathway and constituent.

Table 2-2. Groundwater Wells Used at VEGP

Well Identification Number	Depth (ft)	Capacity (gpm)	Primary Purpose
MU-1	851	2,000	Service water, potable and sanitary water, fire protection, plant water, irrigation
MU-2A	884	1,000	Back-up for MU-1
TW-1	860	1,000	Back-up for production well make-up system
SW-5	200	20	Water for old security tactical training area
REC	265	150	Potable water for recreation facility
CW-3	220	Not Available	Water supply for Nuclear Operations Garage
IW-4	370	120	Irrigation well for vegetation
SEC	320	10	Non-potable water supply for lavatory at plant entrance security building
SB	340	50	Potable water for Training Facility

Source: SNC 2007a

The impact of VEGP operations on water quality within the Savannah River is evaluated by monitoring associated with the facility's Radiological Environmental Monitoring Program (REMP). Samples collected to monitor for potential releases of radionuclides to surface water include surface water samples, drinking water samples, shoreline sediment samples, and fish tissue samples. The VEGP program is operated in accordance with the VEGP ODCM and the results are documented within the Annual Radiological Environmental Operating Reports. REMP sampling began in 1981, providing more than 5 years of pre-operational water quality data (SNC 2007g).

The most recent REMP report was completed in 2007 for the calendar year 2006 (SNC 2007g). The components of the VEGP monitoring program related to surface water quality are described in Table 2-3.

Table 2-3. Summary of 2006 VEGP Surface Water Quality Monitoring Program

Sample Type	Location Number and Location	Indicator or Control	Number of Samples in 2006 Program	Analytes
Surface Water	Savannah River, RM 151.2, Location 82	Control	12	Gamma isotopic (monthly), tritium (quarterly)
Surface Water	Savannah River, RM 150.4, Location 83	Indicator	12	Gamma isotopic (monthly), tritium (quarterly)
Surface Water	Savannah River, RM 149.5, Location 84	Indicator	12	Gamma isotopic (monthly), tritium (quarterly)
Drinking Water	Beaufort-Jasper Water Treatment Plant, Location 87	Indicator	12	Gamma isotopic and gross beta (monthly), tritium (quarterly), I-131 when dose dictates
Drinking Water	Cherokee Hill Water Treatment Plant, Location 88	Indicator	12	Gamma isotopic and gross beta (monthly), tritium (quarterly), I-131 when dose dictates
Drinking Water	Purrysburg Water Treatment Plant, Location 89	Indicator	12	Gamma isotopic and gross beta (monthly), tritium (quarterly), I-131 when dose dictates
Shoreline Sediment	Savannah River, RM 150.2 (usually), Location 83	Indicator	2	Gamma isotopic (semi annually)
Fish Tissue	Savannah River, RM 153 to 158, Location 81	Control	2	Gamma isotopic (semi annually)
Fish Tissue	Savannah River, RM 144 to 149.4, Location 85	Indicator	2	Gamma isotopic (semi-annually)

The results from the 2006 REMP program report indicate that tritium releases from VEGP may have resulted in increases of tritium concentrations in river water in the Savannah River near the facility (SNC 2007g). In 2006, total tritium releases from the facility were higher than normal due to several outages (SNC 2007g). In addition, drought conditions resulted in a lower volume of water present in the river (SNC 2007g). These resulted in tritium concentrations in water samples ranging from 1140 to 3870 picoCuries/liter (pCi/l). Because the indicator sample tritium concentrations were higher than the control sample concentrations, the tritium concentrations could be indicative of plant releases (SNC 2007g). These values are still well below the EPA Maximum Contaminant Level (MCL) of 20,000 pCi/l tritium for drinking water. Also, the report notes that the Savannah River is not used as a drinking water source for more than 100 miles downstream of VEGP (SNC 2007g). Tritium concentrations in samples collected from pre-treated and treated water at these drinking water sources (Beaufort-Jasper, Cherokee Hill, and Purrysburg) were not statistically different from the tritium concentrations at the control location (Augusta) (SNC 2007g).

REMP sampling results for sediment detected two man-made radionuclides (Cs-137 and Co-60) that may be attributed to VEGP operations or other sources (SNC 2007g). The plots of historical Cs-137 and Co-60 concentrations at these sampling locations do not show any increasing or decreasing trend (SNC 2007g).

The REMP program included sampling of fish tissue samples at both control and indicator locations, with the results analyzed only for gamma isotopic analysis (not tritium). The results did not identify any radionuclides that had a statistical difference between the indicator and control samples, so there is no discernable impact from facility operations (SNC 2007g).

The GEDP Program is similar in scope to the VEGP annual program and the results are reported in the GDNR's Environmental Radiation Surveillance Report. The most recent finalized version of this report covers the period from 2000 to 2002 (GDNR 2004). Due to the proximity of VEGP and SRS, the GDNR Environmental Radiation Surveillance Monitoring Program includes the collection and analysis of samples whose locations were selected to provide an assessment of radiation releases and water quality potentially impacted by both facilities. The program includes the collection of samples from air, rain, vegetation, crops, game, milk, groundwater, surface water, soil, sediment, drinking water, and fish. A summary of the tritium results are in Table 2-4.

In addition to the tritium detections, elevated concentrations of Cs-137 and Sr-90 were also detected in fish tissue in the samples collected adjacent to SRS, with concentrations that exceeded the NRC reporting limit (GDNR 2004). Several radionuclides were also detected in sediment samples up to 100 miles downstream of SRS, including Co-60, Sr-90, Cs-137, Pu-238, and Pu-239. The GDNR report stated that a portion of the Co-60 may have been attributable to VEGP releases, but the remainder were attributed to SRS, as well as global fallout (GDNR 2004).

Table 2-4. Summary of 2000 to 2002 GDNR Surface Water Tritium Results

Sample Type	Location	Average Tritium Concentration	Maximum Tritium Concentration	Maximum as a % of the MCL
Surface Water	Savannah River, SRS Outfall	5,700 pCi/L	60,000 pCi/L	300%
Surface Water	Savannah River, VEGP Outfall	2,200 pCi/L	11,000 pCi/L	55%
Surface Water	Savannah River, downstream	1,000 pCi/L	3,300 pCi/L	17%
Drinking Water	Savannah	900 pCi/L	2,300 pCi/L	12%
Fish	Savannah River, SRS Outfall	2,000 pCi/kg	47,000 pCi/kg	0.7%
Fish	Savannah River, VEGP Outfall	1,100 pCi/kg	2,500 pCi/kg	0.04%
Fish	Savannah River, downstream	600 pCi/kg	1,880 pCi/kg	0.03%

Source: GDNR 2004

The only other radionuclide detected in fish tissue samples collected by GPC during VEGP's operation was I-131. Historically, I-131 was detected in 1989 at one downstream station at 18 pCi/kg-wet, and it was detected in 1990 at one downstream station at 13 pCi/kg-wet and one upstream control station at 12 pCi/kg-wet. All three of these detections were below the minimum detectable concentration (MDC) for I-131 of 53 pCi/kg-wet (SNC 2007g). GPC does not analyze fish tissue samples for tritium.

SRS has collected freshwater fish from nine locations on the Savannah River – from above SRS at Augusta, Georgia to the coast at Savannah, Georgia. SRS found the radionuclides Cs-137, I-129, and TC-99 in Savannah River edible fish composites. Sr-89, Sr-90, and tritium were detected at most of the SRS freshwater river locations. Pu-238 was found slightly above the MDC in composites from eight freshwater locations. Cs-137 and Sr-89/90 concentrations in 2006 were similar to those of previous years (Westinghouse Savannah River Company Inc. 2007).

The primary conclusion from both the VEGP and GEPD monitoring programs is that releases of radionuclides have occurred from both the SRS and VEGP facilities into the Savannah River.

However, SRS is believed to be the primary source of the radionuclides, with VEGP contributing up to 10 percent of the tritium detected in the Savannah River (GDNR 2004).

Pursuant to the Federal Water Pollution Control Act (also known as the Clean Water Act [CWA]), VEGP effluent discharges are regulated by a NPDES permit. The current permit, Number GA0026786, was issued by the GDNR on June 30, 1999. The current permit expiration date was May 31, 2004, and was extended indefinitely by GDNR on that date. Sample collection to demonstrate compliance with this NPDES permit is the only requirement of the non-radiological Annual Environmental Operating Report required by NRC (SNC 2007h).

The quantitative effluent limitations regulated under the VEGP NPDES permit are shown in Table 2-5. There are eleven separate outfalls regulated under this permit. Of these, Outfall 001 is designated as the Final Plant Discharge into the Savannah River, through the underground discharge pipe. Most of the other Outfalls (002 through 011) consist of discharges of various water systems into Outfall 001. The only exceptions are:

- Outfalls 002A and 003A, which are emergency overflows to storm drains;
- Outfall 006, which is the emergency overflow from the Sewage Treatment Plant to the Savannah River; and
- Outfall 011, which is the backwash from the Intake Screens directly into the Savannah River at the intake screen location (SNC 2007a).

The effluent limitations for each outfall are provided in Table 2-5.

The NPDES permit does not regulate the discharge of radionuclides from the facility, and does not require routine monitoring of the temperature of the discharge to the Savannah River (SNC 2007a).

A review of the quarterly NPDES Discharge Monitoring Reports since 2002 identified a total of six exceedances, or possible exceedances, of permit standards (SNC 2007i). These included two sample results that exceeded permit standards for oil and grease (O&G), two that exceeded standards for Total Suspended Solids (TSS), one that may have exceeded a standard for Total Residual Chlorine, and one event in which influent flow exceeded the capacity of the Waste Water Retention Basins, resulting in a discharge of water that bypassed the required outfall (SNC 2007i). In all cases, these exceedances were relatively minor, did not result in impacts to the Savannah River, and did not result in enforcement action. Also, each event was immediately reported to GDNR, investigated, and corrective actions taken (SNC 2007i).

Table 2-5. Effluent Limitations – NPDES Permit for VEGP

Outfall No.	Outfall Description	Free Available Chlorine (mg/L)		Total Suspended Solids (mg/L)		Oil and Grease (mg/L)		Total Cr (mg/L)	Total Zn (mg/L)	pH	Biochemical Oxygen Demand (mg/L)	
		Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Daily Max.	Daily Max.	Range	Daily Avg.	Daily Max.
001	Final Plant Discharge to Savannah River	NA	NA	NA	NA	NA	NA	NA	NA	6-9	NA	NA
002	Unit 1 Cooling Tower Blowdown to 001	0.2	0.5	NA	NA	NA	NA	0.2	1.0	NA	NA	NA
002A	Emergency Overflow to Storm Drains	0.2	0.5	NA	NA	NA	NA	0.2	1.0	NA	NA	NA
003	Unit 2 Cooling Tower Blowdown to 001	0.2	0.5	NA	NA	NA	NA	0.2	1.0	NA	NA	NA
003A	Emergency Overflow to Storm Drains	0.2	0.5	NA	NA	NA	NA	0.2	1.0	NA	NA	NA
004	Unit 1 Wastewater Retention Basin to 001	NA	NA	30.0	100.0	15.0	20.0	NA	NA	NA	NA	NA
005	Unit 2 Wastewater Retention Basin to 001	NA	NA	30.0	100.0	15.0	20.0	NA	NA	NA	NA	NA

Table 2-5. (cont'd)

Outfall No.	Outfall Description	Free Available Chlorine (mg/L)		Total Suspended Solids (mg/L)		Oil and Grease (mg/L)		Total Cr (mg/L)	Total Zn (mg/L)	pH	Biochemical Oxygen Demand (mg/L)	
		Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Daily Max.	Daily Max.	Range	Daily Avg.	Daily Max.
006	*Sewage treatment* Plant Emergency Overflow to Savannah River	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.0	45.0
007	Unit 1 Liquid Rad Waste Systems Discharge to 001	NA	NA	30.0	100.0	15.0	20.0	NA	NA	NA	NA	NA
008	Unit 2 Liquid Rad Waste Systems Discharge to 001	NA	NA	30.0	100.0	15.0	20.0	NA	NA	NA	NA	NA
009	Nuclear Service Cooling Tower Blowdown to 001	0.2	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
010	Rad Waste Dilution Flow to 001	NA	NA	NA	NA	NA	NA	NA	NA	6-9	NA	NA
011	Intake Screen Backwash to Savannah River	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

mg/l = milligrams per liter

2.2.3.2 Groundwater

The VEGP REMP program has not historically required the collection and analysis of groundwater samples (SNC 2007g). However, in 2007, VEGP voluntarily implemented a groundwater sampling program which will consist of samples from 29 wells and one surface water location (SNC 2007j). The results will be provided within future REMP reports, but will not be available until the issuance of the 2007 REMP report in 2008 (SNC 2007j).

Groundwater samples are included in the GDNR radiological monitoring program (GDNR 2004). This program includes the sampling of 42 monitoring wells and 37 groundwater supply wells. The sampling frequency is once per year, and the samples are analyzed for gross alpha, gross beta, and tritium. The supply well samples have also been analyzed for Cs-137.

According to the GDNR report, tritium was unexpectedly detected in several relatively deep wells in Burke County, Georgia, in 1991 (GDNR 2004). Tritium had been expected to be present in Water Table aquifer wells, due to the history of releases of tritium from SRS, but it was not expected to be present in the confined Tertiary or Cretaceous aquifers. Based on these data, GDNR partnered with the DOE to perform an extensive, regional groundwater study. The results of this study concluded that no significant tritium was present in the deeper aquifers.

During the 2000 to 2002 study, tritium concentrations in the Water Table aquifer averaged less than 1,000 pCi/L, compared to the MCL of 20,000 pCi/L. The distribution of tritium in the Water Table aquifer indicated that its source was likely to be airborne or precipitation-related tritium from SRS (GDNR 2004). No other radionuclides were detected in the GDNR groundwater samples.

The VEGP facility does perform groundwater monitoring associated with two landfills on the property. Landfill #2 is operated by VEGP under Solid Waste Permit #017-006D(L)(I), and is used for the disposal on non-putrescible, non-liquid solid waste such as office waste, construction and demolition debris, pallets, and concrete (SNC 2007k). Groundwater monitoring began at Landfill #2 in 2002, through the sampling of four wells screened in the uppermost Water Table aquifer (SNC 2007k). The monitoring samples are analyzed for total metals and volatile organic compounds (VOCs). This sampling program has not identified any statistically significant releases of any contaminants to the groundwater.

Landfill #3 is operated by VEGP under Solid Waste Permit #017-007D(L)(I), and began operations in 1987 (SNC 2007l). Since 1992, Landfill #3 has been used the disposal of only construction and demolition debris. The groundwater monitoring program consists of samples from nine Water Table Aquifer wells, which are analyzed for total metals and VOCs. The results from Landfill #3 have documented the presence of barium, mercury, and VOCs (trichlorofluoromethane, 1,1-dicholorethene, 1,1-dichloroethane, chlorobenzene, and cis-1,2-dichloroethene) (SNC 2007l).

2.2.4 Meteorology and Air Quality

VEGP is located in Burke County, Georgia. This region has a humid subtropical climate characterized by long periods of mild sunny weather in the autumn, short mild winters, somewhat more windy but mild weather in the spring, and long hot humid summers (SNC 2005b). The Gulf of Mexico and the Atlantic Ocean are approximately 250 miles south-southwest and 100 miles southeast, respectively. Both the Appalachian chain of mountains and these two nearby maritime bodies exert an important influence on the climate. The mountains to the north tending to retard the southward movement of Polar air masses. The Bermuda High pressure areas of the Atlantic Ocean have a dominant effect on the weather, particularly in the summer months. East or northeast winds produce the most unpleasant weather although southerly winds are quite humid during the summer (NOAA 2004).

Georgia has a mild climate, with an average temperature of 63°F. The mountainous north has cooler summers and fairly cold winters. For example, northern mountains are generally colder than the rest of the state, with an average temperature of 78° F in July and 45° F in January. The southern portion of the state has a July average of 82°F and a January average of 54°F. The highest temperature ever recorded in the state was 112°F at Greenville, GA on August 20, 1983. The lowest recorded temperature, -17°F, occurred in Floyd County on January 27, 1940 (World Book Encylopedia 2006).

The state's precipitation (in forms of rain, melted snow, and other forms of moisture) averages 50 inches per year. The greatest amount of precipitation occurs in mid summer. The rainiest months are July and August, and the driest are October and November. Rainfall ranges from approximately 56 inches a year in the north to about 48 inches near the east and central portions of Georgia. About one inch of snow falls yearly in the state (World Book Encylopedia 2006).

VEGP is located in a region of relatively low tornado activity and is far enough inland that the strong winds associated with tropical storms and hurricanes are greatly reduced, although these storms can cause heavy precipitation in late summer (SNC 2005b).

There are no Class I areas designated by the National Park Service, U.S. Fish and Wildlife Service (FWS), or the U.S. Forest Service within 50 miles of the site. Class I areas, as defined in the Clean Air Act, are the following areas that were in existence as of August 7, 1977: national parks over 6000 acres, national wilderness areas and national memorial parks over 5000 acres, and international parks (NPS 2006a). The closest Class I area is Cohutta

Wilderness Area, Georgia and Shining Rock Wilderness Area, North Carolina – both approximately 200 miles northwest and north northwest, respectively, of VEGP (NPS 2006b).

All areas within the Augusta-Aiken area are classified as achieving attainment with the National Ambient Air Quality Standards (NAAQS; 40 CFR 81.311 and 40 CFR 81.341). The NAAQS define ambient concentration criteria for sulfur dioxide (SO2), particulate matter with aerodynamic diameters of 10 microns or less (PM10), particulate matter with aerodynamic diameters of 2.5 microns or less (PM 2.5), carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), and lead (Pb). These pollutants are generally referred to as "criteria pollutants." Areas of the United States having air quality as good as or better than the NAAQS are designated by the EPA as attainment areas. Areas having air quality that is worse than the NAAQS are designated by EPA as non-attainment areas. The nearest non-attainment area to VEGP is the Columbia, South Carolina metropolitan area, a non-attainment area under the 8-hour O3 standard, located approximately 80 miles northeast of the plant (SNC 2005b). The currently designated non-attainment areas for all criteria pollutants for areas in Georgia are as follows:

- Atlanta, GA – 8-hour O3 and PM 2.5
- Macon, GA – 8-hour O3 and Pm 2.5
- Rome, GA – PM 2.5
- Chattahoochee National Forest Mountains in Murray County – 8-hour O3

The non-attainment areas of South Carolina are as follows:

- Columbia, SC – 8-hour O3
- Greenville-Spartanburg-Anderson – 8-hour O3 (EPA 2006)

2.2.5 Aquatic Resources

The aquatic resources relevant to the operation of VEGP are those of the Savannah River. The location of VEGP and the river is shown in Figure 2-3. This section describes the aquatic biota of the Savannah River in the vicinity of the VEGP site, as well as other water bodies in the transmission line ROWs, that potentially could be affected by the future operation and maintenance of VEGP and the associated transmission lines.

2.2.5.1 Savannah River

The Savannah River is the largest and most important aquatic resource in the vicinity of the VEGP site. The river borders the VEGP site on the north and east, and the site is located between RM 150 and 152. This area is within the reach referred to as the middle Savannah River, which has been defined as the river segment from the Fall Line (a line along which waterfalls occur at the transition from the Piedmont to the Coastal Plain) just above Kiokee Creek in Columbia County at RM 221 (between Augusta and J. Strom Thurmond Lake) south to the mouth of Brier Creek at RM 97 in Screven County (Figure 2-4). The middle Savannah River basin, which includes this reach of the Savannah River and all the tributaries that empty into this reach, is typical of southeastern river basins – it is home to a diverse fish community and, like other southeastern rivers, its watershed is increasingly affected by a growing human population. The Savannah River provides several habitat types for fish, including the main river channel, "cutoff bends" or "dead rivers" (former channels still connected to the main channel), and streams or smaller tributaries that empty into the river. Additional fish habitat is provided by swamps (such as the Savannah River Swamp along the river mainly on the SRS) and floodplains during high water. The main river channel within this reach generally has a substrate of sand, but other substrate types also are present, including gravel where there is moderate flow and mud and plant detritus in backwaters (Marcy et al. 2005). The aquatic organisms inhabiting the Savannah River include fish, benthic macroinvertebrates (including mussels, clams, and aquatic insects), aquatic macrophytes, attached algae, and diatoms.

The aquatic community of the area of the Savannah River adjacent to the VEGP site has been extensively studied over a long period of time because of the presence of the SRS, as discussed in Section 2.1. The five SRS reactors, which operated intermittently during the period from the mid-1950s to 1988, employed once-through cooling systems that used cooling water from the Savannah River and discharged heated water to tributaries of the river. Baseline ecological studies of the Savannah River began in 1951 prior to construction, numerous studies were performed during the more than 30 years of reactor operation, and other studies are ongoing (Reed et al. 2002).

The Academy of Natural Sciences (ANS) in Philadelphia was initially selected to conduct the baseline ecological studies at SRS, and since 1951 it has continued to conduct biological and water-quality studies of this reach of the Savannah River to assess the effects of SRS on the aquatic community. The results provide one of the most comprehensive ecological data sets available for any river in the world (ANS 2003). The ANS assessments were focused in the vicinity of the SRS between RM 161 and RM 122. Until 1997, these assessments included comprehensive studies at sites in the Savannah River along the SRS, cursory studies in the Savannah River in the vicinity of the SRS, and independent monitoring of two locations near the VEGP site. The comprehensive studies included a twice-per-year assessment every 4 years of all study components and all sampling locations. The cursory studies were annual assessments with four sampling periods per year of fewer study components and fewer sample locations. Studies in the vicinity of the VEGP site, which included the same components as the comprehensive surveys but different sampling locations, were initiated in 1985 in order to assess potential impacts from VEGP so they could be separated from potential SRS impacts. For this purpose, the ANS included studies starting in 1985 at two stations adjacent to the VEGP site. A station upstream of VEGP (Station 2A) was located at RM 151.2, and a downstream station (Station 2B) was located approximately 1.0 miles below the VEGP cooling water discharge at RM 149.8. From 1985 through 1996, studies were performed approximately every 2 years (ANS 2003).

Starting in 1997, the sampling design was simplified to an annual, early fall assessment of diatoms, attached algae and aquatic macrophytes, aquatic insects, non-insect macroinvertebrates, and fish at four stations. The four stations included a reference station upstream of SRS and VEGP (Station 1), and three downstream stations potentially exposed to the influence of SRS and VEGP (Stations 2B, 5 and 6). The sampling design began another transition in 2001, the last year in which fish were sampled at Station 2B (ANS 2003).

Fish Community

As discussed above, the fish community and other aquatic resources of the middle Savannah River basin have been characterized by numerous studies, the most comprehensive of which is documented in the series of reports by the ANS. The latest fish survey performed by the ANS, which included samples from stations upstream and downstream of VEGP, was in the fall of 2001 (ANS 2003).

The fish community of the middle Savannah River basin includes approximately 84 native species and 13 introduced species (Marcy et al. 2005). Comparison of this community to those of four other river drainages in the region indicates that the Savannah River is not unusual in its species composition or number of species (Marcy et al. 2005). The fishes of the middle Savannah River basin can be grouped into three main categories based on their life histories: 1) resident freshwater species (present in the area throughout all life stages), 2) diadromous species (migratory species present only during certain life stages), and 3) marine/estuarine species (sometimes found in the river upstream of the saltwater-freshwater interface) (Marcy et al. 2005). A listing of the native resident, diadromous, and marine fish species that occur in the middle Savannah River basin is provided in Table 2-6.

Table 2-6. Native Resident, Diadromous, and Marine Fish Species of the Middle Savannah River Basin

Family	Common Name	Scientific Name
Resident Species		
Lepisosteidae (gars)	longnose gar	*Lepisosteus osseus*
	Florida gar	*Lepisosteus platyrhincus*
Amiidae (bowfin)	bowfin	*Amia calva*

Table 2-6. (cont'd)

Family	Common Name	Scientific Name
Clupeidae (herrings & shads)	gizzard shad	*Dorosoma cepedianum*
Cyprinidae (minnows)	bannerfin shiner	*Cyprinella leedsi*
	whitefin shiner	*Cyprinella nivea*
	eastern silvery minnow	*Hybognathus regius*
	rosyface chub	*Hybopsis rubrifrons*
	bluehead chub	*Nocomis leptocephalus*
	golden shiner	*Notemigonus crysoleucas*
	ironcolor shiner	*Notropis chalybaeus*
	dusky shiner	*Notropis cummingsae*
	spottail shiner	*Notropois hudsonius*
	yellowfin shiner	*Notropis lutipinnis*
	taillight shiner	*Notropois maculatus*
	coastal shiner	*Notropis petersoni*
	pugnose shiner	*Opsopoeodus emiliae*
	lowland shiner	*Pteronotropis stonei*
	creek chub	*Semotilus atromaculatus*
Catostomidae (suckers)	quillback	*Carpiodes cyprinus*
	highfin carpsucker	*Carpiodes velifer*
	creek chubsucker	*Erimyzon oblongus*
	lake chubsucker	*Erimyzon sucetta*
	northern hogsucker	*Hypentelium nigricans*
	spotted sucker	*Minytrema melanops*
	notchlip redhorse	*Moxostoma collapsum*
	robust redhorse	*Moxostoma robustum*
	brassy jumprock	*Scartomyzon* sp.
Ictaluridae (bullhead catfishes)	snail bullhead	*Ameiurus brunneus*
	white catfish	*Ameiurus catus*
	yellow bullhead	*Ameiurus natalis*
	brown bullhead	*Ameiurus nebulosus*
	flat bullhead	*Ameiurus platycephalus*
	tadpole madtom	*Noturus gyrinus*
	margined madtom	*Noturus insignis*
	speckled madtom	*Natures leptacanthus*
Esocidae (pikes & pickerels)	redfin pickerel	*Esox americanus*
	chain pickerel	*Esox niger*
Umbridae (mudminnows)	eastern mudminnow	*Umbra pygmaea*
Aphredoderidae (pirate perch)	pirate perch	*Aphredoderus sayanus*
Amblyopsidae (cave fishes)	swampfish	*Chologaster cornuta*

Table 2-6. (cont'd)

Family	Common Name	Scientific Name
Fundulidae (top minnows)	golden topminnow	*Fundulus chrysotus*
	lined topminnow	*Fundulus lineolatus*
Poeciliidae (livebearers)	eastern mosquitofish	*Gambusia holbrooki*
Atherinopsidae (New World silversides)	brook silverside	*Labidesthes sicculus*
Centrarchidae (sunfishes)	mud sunfish	*Acantharchus pomotis*
	flier	*Centrarchus macropterus*
	blackbanded sunfish	*Enneacanthus chaetodon*
	bluespotted sunfish	*Enneacanthus gloriosus*
	banded sunfish	*Enneacanthus obesus*
	redbreast sunfish	*Lepomis auritus*
	pumpkinseed	*Lepomis gibbosus*
	warmouth	*Lepomis gulosus*
	bluegill	*Lepomis macrochirus*
	dollar sunfish	*Lepomis marginatus*
	redear sunfish	*Lepomis microlophus*
	spotted sunfish	*Lepomis punctatus*
	redeye bass	*Micropterus coosae*
	largemouth bass	*Micropterus salmoides*
	black crappie	*Pomoxis nigromaculatus*
Elassomatidae (pygmy sunfishes)	Everglades pygmy sunfish	*Elassoma evergladei*
	bluebarred pygmy sunfish	*Elassoma okatie*
	banded pigmy sunfish	*Elassoma zonatum*
Percidae (darters & perches)	Savannah darter	*Etheostoma fricksium*
	swamp darter	*Etheostoma fusiforme*
	Christmas darter	*Etheostoma hopkinsi*
	turquoise darter	*Etheostoma inscriptum*
	tessellated darter	*Etheostoma olmstedi*
	sawcheek darter	*Etheostoma serrifer*
	blackbanded darter	*Percina nigrofasciata*
Diadromous Species		
Acipenseridae (sturgeons)	shortnose sturgeon	*Acipenser brevirostrum*
	Atlantic sturgeon	*Acipenser oxyrinchus*
Anguillidae (freshwater eels)	American eel	*Anguilla rostrata*
Clupeidae (herrings & shads)	blueback herring	*Alosa aestivalis*
	hickory shad	*Alosa mediocris*
	American shad	*Alosa sapidissima*

Table 2-6. (cont'd)

Family	Common Name	*Scientific Name*
Moronidae (temperate basses)	striped bass	*Morone saxatilis*
Marine Species		
Megalopidae (tarpon)	tarpon	*Megalops atlanticus*
Belonidae (needle fish)	Atlantic needlefish	*Strongylura marina*
Mugilidae (mullets)	mountain mullet striped mullet	*Agonostomus monticola* *Mugil cephalus*
Achiridae (American soles)	hogchoker	*Trinectes maculatus*
Adapted from Marcy et al. 2005		

Freshwater Resident Fishes

The results of the 2000 ANS study illustrate the freshwater resident fish species that are most abundant in the fish community of the middle Savannah River. A total of 4599 individuals of 50 species of fish were collected. The species most frequently collected were the spottail shiner (*Notropis hudsonius*; 36.5 percent of the total number of fish caught), followed by the bannerfin shiner (*Cyprinella leedsi*; 11.7 percent) and bluegill (*Lepomis macrochirus*; 10.8 percent). The brook silverside *(Labidesthes sicculus*, 6.7 percent*)* and whitefin shiner (*Cyprinella nivea*; 6.5 percent) also were relatively common. These five species together made up approximately 72 percent of the total catch. Other commonly collected species were the redbreast sunfish (*Lepomis auritus*), rosyface chub (*Hybopsis rubrifrons*), coastal shiner (*Notropis petersoni*), largemouth bass (*Micropterus salmoides*), and spotted sucker (*Minytrema melanops*). No statistically significant differences were found between stations for species richness, species diversity, or density. These results were similar to the 1999 study results and were concluded to provide no evidence of impacts on the fish community of the river (ANS 2001).

In the 2001 ANS study, a total of 3951 specimens of 48 species of fish were collected, and the species composition was similar to the 2000 results. The most common species was the spottail shiner (24.4 percent of the total number of fish), followed by the taillight shiner (*Notropis maculatus*, 19.5 percent). The bluegill (5.1 percent), bannerfin shiner (5.0 percent), and whitefin shiner (4.1 percent) also were relatively common. These five species together made up approximately 58 percent of the total catch (ANS 2003). Results from the 2001 ANS study indicated that species richness at the sampling location downstream of the VEGP cooling water discharge was significantly higher than at the upstream location. However, neither species diversity nor the densities of common species differed significantly between stations and, in general, there was greater temporal than spatial variation in fish assemblages between the study sites. These results were similar to the 2000 study results and were concluded to provide no evidence of impacts on the fish community of the river (ANS 2003).

The Savannah River and the mouths of creeks flowing into the river also were sampled intensively as part of a study of the SRS during the period 1983 to 1985. Electrofishing collections from this period were dominated by Centrarchids, which made up approximately 60 percent of all fish collected. Redbreast sunfish, bluegill, and largemouth bass appeared most frequently in the collections, representing 17, 14, and 9 percent, respectively, of fish collected. They were followed in frequency by spotted sucker (8 percent), spotted sunfish (*Lepomis punctatus*; 8 percent), chain pickerel (*Esox niger*; 5 percent), and bowfin (*Amia calva*; 5 percent). In the same study, hoop net collections were numerically dominated by flat bullhead (*Ameiurus platycephalus*; 29 percent), channel catfish (*Ictalurus punctatus*; 21 percent), redbreast sunfish (10 percent), and white catfish (*Ameiurus catus*; 9 percent). These species are habitat generalists that are all commonly found in large southeastern Coastal Plain river systems in habitats that include sloughs, backwaters, oxbow lakes, small tributary streams, and small impoundments on these tributaries (SNC 2007a).

The 1983-1984 study also included separate surveys of smaller fish species that serve as prey for larger predators, including predators of recreational importance such as largemouth bass, black crappie (*Pomoxis nigromaculatus*), striped bass (*Morone saxatilis*), white bass (*Morone chrysops*), and hybrid bass (*Morone saxatilis* X *Morone chrysops*). The small fish collected in the surveys predominantly were shiners (genus *Notropis*), which made up 89 percent of all fish collected, and other species collected regularly were brook silversides, lined topminnow (*Fundulus lineolatus*), golden shiner (*Notemigonus crysoleucas),* and mosquitofish (*Gambusia* spp.), all of which are common residents of swamps, bayous, and streams in the southeastern U.S. The 1983-1984 study did not distinguish between the various species of *Notropis* collected; however, a follow-up survey of small, minnow-like fish in the Savannah River and its tributaries found that more than two-thirds of those collected consisted of three Notropid species: the coastal shiner (40 percent), dusky shiner (*Notropis cummingsae*; 17 percent), and spottail shiner (10 percent) (SNC 2007a).

Thus, the resident freshwater fishes of the middle Savannah River include a variety of mainly minnows (family Cyprinidae), sunfish (family Centrarchidae), suckers (family Catastomidae), catfish (family Ictaluridae), and darters (family Percidae).

<u>Diadromous Fishes</u>

Diadromous fishes of the middle Savannah River include sturgeons (family Acipenseridae), shad and herrings (family Clupeidae), temperate basses of the genus *Morone*, and one eel (family Anguillidae) (SNC 2007a). Species within these groups are mainly anadromous (spawning and beginning life in freshwater but mostly living and growing to sexual maturity in estuaries or the ocean) except the eel, which is catadromous (growing to sexual maturity in freshwater but migrating to the ocean to spawn) (Marcy et al. 2005). Several of these species are or historically have been important commercially. There is no essential fish habitat (EFH) designated by the National Marine Fisheries Service (NMFS) in the reach of the Savannah River near the site. EFH is defined as those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity of marine, estuarine, or anadromous animals. NMFS designates EFH in accordance with the provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, 16 USC 1801 et seq.). Although this reach of the Savannah River has no designated EFH, the diadromous fishes that occur in the middle Savannah River and have designated EFH in the south Atlantic region off the coast of the Carolinas, Georgia, or Florida are discussed below.

Sturgeons

The Savannah River is among the spawning rivers used by the two species of anadromous sturgeon that occur on the east coast of the United States, the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus*). The shortnose sturgeon is an endangered species and is discussed in Section 2.2.5.4. The Atlantic sturgeon is considered a species of concern by National Oceanic and Atmosphere Administration (NOAA). A species of concern is not protected under the Endangered Species Act (ESA) of 1973 (16 USC 1531), but concerns about its status indicate that it may warrant listing in the future (NMFS 1998).

The Atlantic sturgeon inhabits the Atlantic coast from New Brunswick, Canada to north Florida and is the largest fish to inhabit freshwaters on the east coast of the United States. It is an anadromous species that ascends coastal rivers to spawn in the early spring, typically spawning in flowing water between the salt front and the fall line of large rivers (NMFS 2007). Atlantic sturgeons enter the Savannah River in February to March and remain there through October, spawning when the current is strong in the spring and fall, with all adults leaving the river by the end of October (Meyer et al. 2003). Historically, it is believed that Atlantic sturgeon occurred throughout the Savannah River, including upstream shoal habitats. Although presently used spawning sites in the Savannah River have not been identified, locations used may be similar to those used by the shortnose sturgeon, which also spawns over hard substrates at river bends (Meyer et al. 2003). Eggs are demersal and adhesive and usually attach to the substrate or submerged vegetation. Young–of-the-year move downstream to nursery areas in the lower portions of rivers and the associated estuaries and young may spend several years in fresh and brackish water before migrating to sea. The Atlantic sturgeon feeds on a variety of benthic macroinvertebrates as a juvenile in estuaries and as an adult in the Atlantic Ocean (SAFMC 1998).

Although historically the Atlantic sturgeon supported important subsistence and commercial fisheries, stocks are depressed range-wide, and in 1990 a Fishery Management Plan (FMP) instituted by the Atlantic States Marine Fisheries Commission (ASMFC) required Atlantic coastal states to enact a closure or moratorium on harvest in order to revive population numbers

(ASMFC 1990). This coast-wide moratorium was implemented in 1998, and NMFS followed this with a similar moratorium for Federal waters (NMFS 2007).

Shad and River Herrings

Three clupeids migrate from the ocean up the Savannah River to spawn in its middle reaches: the American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), and blueback herring (*Alosa aestivalis*). Two other clupeids, the gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*Dorosoma petenense*), also spawn in the middle Savannah River, but remain in fresh to brackish water and do not migrate between the river and the ocean; thus, they are not strictly anadromous. Gizzard shad are found in brackish water as adults while threadfin shad tend to remain in freshwater (SNC 2007a, Marcy et al. 2005)

The American shad, the largest member of the herring family, has a long history of supporting commercial and recreational fisheries along the east coast since the early 1800s, and it was the most valuable food fish on the east coast prior to World War II. There have been reduced commercial harvests (NRC 2007), and the sport fishery for this species has recently become more important economically than the commercial fishery. As a result, the species has become the focus of major restoration programs (SAFMC 1998). American shad forage mostly offshore for a variety of invertebrates but depend on riverine systems for spawning, often returning to their natal streams (Weiss-Glanz et at. 1986). American shad spawn in the Savannah River between January and April (Meyer et al. 2003), when water temperatures are approximately 57 to 70°F (14 to 21°C; SAFMC 1998). The eggs are released into the water column and are demersal but not adhesive, so they tend to sink and are slowly carried downstream. Larvae drift downstream to the estuary probably between February and June (Weiss-Glanz et at. 1986, Stier and Crance 1985). Juveniles remain in fresh to brackish waters of lower rivers and their estuaries until temperatures begin to drop in late fall, when they migrate to sea. Most adults from southeastern rivers die after spawning (Marcy et al. 2005). A considerable number of American shad likely pass the VEGP during their annual spawning run. A study in 2001 and 2002 developed estimates of the American shad population size in the middle Savannah River by examining their movement through the New Savannah River Bluff Lock and Dam, located below Augusta, Georgia, and approximately 36 miles upstream of VEGP at RM 187. The estimated population of American shad that reached this point in the river was 158,000 in 2001 and 217,000 in 2002 (Bailey et al. 2004).

The hickory shad is a medium-sized clupeid that is most abundant in the mid-Atlantic region of the east coast. Historically, the hickory shad had no importance in commercial fisheries, but the species has become popular with recreational fishermen in some southeastern rivers. Its biology and life history are not as well known as other shads and herrings. The hickory shad is usually the first of the anadromous clupeids to ascend spawning rivers in late winter or early spring, when water temperatures are 54 to 55°F (12 to 13°C). Spawning can occur from March to early May in southeastern rivers. The most frequently used spawning habitat is well up coastal rivers in creeks, ponds, lakes, and backwaters (Marcy et al. 2005, SAFMC 1998). Juveniles leave the freshwater and brackish portions of natal rivers in early summer and migrate to nursery areas in the associated estuaries. Their distribution and migration once they enter the ocean is essentially unknown. Adults feed primarily on fish and also consume invertebrates, but they do not feed during the spawning migration (SAFMC 1998).

The blueback herring is smaller than the American and hickory shads and is an important forage fish for other fish species. It is a schooling species that spawns in tributary rivers of estuaries along the east coast from Nova Scotia to Florida. Historically, it has been the basis of an important commercial fishery (SAFMC 1998). Adults and larger juveniles are marine. Adults enter freshwater portions of rivers to spawn in fresh or slightly brackish water with a bottom of sand, gravel, or boulders. They probably return to their natal stream to spawn. The spring spawning period begins in the Carolinas in March to early May, but adults may begin migrating into fresh water in late winter. After spawning, adult fish return to the sea almost immediately. Juveniles may remain in the lower river reaches or may move upstream in summer before migrating downstream in late fall. Adults feed mainly on zooplankton and sometimes fish, but forage little during the spawning run while in freshwater (Marcy et al. 2005).

Striped bass

The striped bass is a wide-ranging species of substantial recreational and commercial importance. All striped bass stocks in rivers of the southeastern United States are anadromous, and the species spawns in estuarine and riverine habitats. In the Savannah River, the degree of anadromy is greatly reduced. Savannah River striped bass tend to spawn in the lower, tidally-influenced areas of the river. Spawning ranged historically from the estuary to the shoals near Augusta, Georgia, but this degree of upstream migration is now prevented by the New Savannah Bluff Lock and Dam (Meyer et al. 2003, SAFMC 1998). Currently, the Savannah River estuary appears to be the most productive area for striped bass reproduction and rearing (Meyer et al. 2003). Striped bass migrate upriver for spring spawning mainly in March, April, and May. Spawning occurs in strong currents of large rivers when the temperature is above 57.9°F (14.4°C) and in areas above the salt wedge of the estuary. The eggs are released into the water column and drift downstream with the current from March to April. The presence of sufficient current to keep the eggs in the water column and to facilitate downstream transport of eggs and larvae influences recruitment success (Marcy et al. 2005, Meyer et al. 2003). Juveniles move downstream to nursery areas that may include tidally-influenced fresh waters and estuaries. The diet of the striped bass initially is planktonic invertebrates and changes gradually with growth to larger invertebrates and fish (SAFMC 1998).

The population of striped bass drastically declined in the 1980s throughout its range on the Atlantic coast. The decline of the fishery in the Savannah River was attributed largely to the

Savannah River harbor modifications and operation of a tide gate installed in the lower estuary in 1977 that altered the habitat of the estuary spawning grounds (GDNR 2007a; Reinert et al. 2005). The alterations changed the flow patterns of the river and increased the salinity levels in parts of the river that were vital for striped bass. Because of the declines in striped bass numbers in the river, a moratorium was placed on the harvest of striped bass in the Savannah River by the State of Georgia in 1988 and the State of South Carolina in 1991. The moratorium affected the free-flowing part of the river up to the New Savannah Bluff Lock and Dam below Augusta at approximately RM 194. Restoration activities that began in the 1990s included efforts to restore salinity and flow patterns, including discontinuation of tide gate operation and closure of the diversion canal. Stock enhancement programs were also modified in the early 1990s to increase fish stocking. The dramatic increase in the catch-per-unit effort of adult striped bass since 1990 appears to be primarily the result of stocking, as 70 percent or more of the catch annually has consisted of stocked fish (Reinert et al. 2005 in NRC 2007). The number of naturally reproducing striped bass remains low. However, in October 2005, the successful restoration efforts led to the end of the harvest moratorium on Savannah River striped bass that was in place since 1991 (Creel 2005).

American eel

The American eel (*Anguilla rostrata*) is the only catadromous fish that occurs in the South Atlantic region, living in freshwater as an adult but returning to the Atlantic Ocean where it was spawned to complete its life cycle (SAFMC 1998). It occurs in fresh, brackish and Atlantic coast waters from Greenland to northeastern South America. The wide geographic range over which American eels exist is directly attributable to their hardiness, tolerance of pollution, ease of transplantation, and ability to traverse damp ground and wet vertical surfaces such as dams (Facey and Van Den Avyle 1987). The American eel supports valuable commercial and limited recreational fisheries throughout its range, and it is an important prey species for larger freshwater and marine fishes (SAFMC 1998). During the fall and winter, sexually mature adults migrate hundreds of miles to the Sargasso Sea to spawn once and then die. Eels have a diverse diet that varies with their life history and consists mainly of invertebrates as well as fish (Meyer et al. 2003).

The life cycle of the American eel is complex and includes oceanic, estuarine, and riverine phases. After hatching, larvae drift with ocean currents for a year before developing into glass eels and moving into freshwater. As they approach coastal areas, glass eels experience a change in pigmentation to dark brown or black. This stage is called an elver. During late winter or spring (or earlier in southern rivers), elvers migrate away from estuarine areas they occupy near the salt-fresh water interface and begin ascending coastal rivers. The end of this migration marks the point when elvers begin to metamorphose into the next stage, yellow eels. Yellow eels are formed in an estuary or river and remain there for up to 14 years before migrating back to the Atlantic Ocean to spawn. During the fall season prior to this migration, yellow eels undergo metamorphosis into the final stage, silver eels (SAFMC 1998).

In the middle Savannah River basin, the most common life stage of the American eel are female, fully pigmented juveniles (yellow eels) (Marcy et al. 2005). High densities of yellow eels were observed in the middle region of the Savannah River, specifically in shallow, non-navigable areas characterized by rocky pool-riffle habitats with submerged aquatic vegetation (McCord 2004). Specifically in the areas surrounding VEGP, eels are found in the mainstem of the Savannah River, the Savannah River swamp, tributary systems, and in impoundments associated with these tributaries (Marcy et al. 2005). Limited information exists on current population trends of the American eel in South Carolina and Georgia, but between 1983 and 1995, commercial landings of eels in Georgia declined more than 80 percent (ASMFC 2000). American eels have historically exhibited high abundance in East Coast streams, composing approximately 25 percent of the total fish biomass (ASMFC 2000). However, in response to steady population declines in the 1980s and 1990s, the ASMFC issued an "Interstate Fishery Management Plan for American Eel" in April 2000 (ASMFC 2000) that proposed several protective measures to help ensure the species' recovery and continued viability. Declining populations are thought to be the result of a variety of factors, including: overfishing of stock; loss of spawning habitat or eggs due to seaweed harvesting in the Sargasso Sea; loss of adult habitat from dams, dredging, and wetland destruction; and impingement and entrainment at water intakes (ASMFC 2000, McCord 2004, Haro et al. 2000). However, at the SRS during a 10-month period in 1977, biweekly samples revealed only one eel impinged on water intake screens (McFarlane et al. 1978).

In 2004, an apparent ongoing decline in the commercial eel harvest prompted a request to FWS and NMFS by ASMFC to review the status of the American eel. This request was granted in September 2004 and in December the two Services announced their intention to consider protecting the American eel under the ESA (FWS 2008a). The FWS initiated a status review in 2005 and in 2007 determined that listing the American eel as a threatened or endangered species was not warranted (FWS 2007a).

Marine/Estuarine Fishes

Marine/estuarine fishes have been collected sporadically in the vicinity of VEGP. The most frequently collected species has been the hogchoker (*Trinectes maculatus*); the striped mullet (*Mugil cephalus*) and Atlantic needlefish (*Strongylura marina*) also have been collected. The numbers of these marine fish that have been collected are small relative to the freshwater resident and diadromous species (ANS 2003, ANS 2001, Marcy et al. 2005). Thus, they are considered a minor component of the fish community of the Savannah River in the vicinity of the site and are of little commercial or recreational importance (SNC 2007a).

Introduced Fishes

Introduced, or non-native, fish species occurring in the middle Savannah River basin are listed in Table 2-7. Introduced species that clearly have become established in the river include the threadfin shad, common carp (*Cyprinus carpio*), channel catfish, and yellow perch (*Perca flavescens*). The table also lists nine other introduced species that are not established or that are rare. None of the introduced fish species are considered nuisance species (Marcy et al. 2005).

Table 2-7. Introduced Fish Species in the Middle Savannah River Basin and Their Establishment Status

Family	Common Name	Scientific Name
Clearly established		
Clupeidae (herrings & shads)	threadfin shad	*Dorosoma petenense*
Cyprinidae (carps & minnows)	common carp	*Cyprinus carpio*
Ictaluridae (bullhead catfishes)	channel catfish	*Ictalurus punctatus*
Percidae (darters and perches)	yellow perch	*Perca flavescens*
Rare and possibly not established		
Cyprinidae (carps & minnows)	goldfish	*Carassius auratus*
Moronidae (temperate basses)	white perch	*Morone americana*
	white bass	*Morone chrysops*
Centrarchidae (sunfishes)	green sunfish	*Lepomis cyanellus*
	white crappie	*Pomoxis annularis*
Clearly not established		
Cyprinidae (carps & minnows)	grass carp	*Ctenopharyngodon idella*
Salmonidae (trouts and salmon)	rainbow trout	*Oncorhynchus mykiss*
Too little information to determine status		
Ictaluridae (bullhead catfishes)	blue catfish	*Ictalurus furcatus*
	flathead catfish	*Pylodictis olivaris*

Adapted from Marcy et al. 2005

Commercially or Recreationally Important Fishes

Among the above categories of native fishes inhabiting the Savannah River are several species that currently are or historically have been harvested commercially or recreationally. Fishes allowed to be caught commercially in the middle Savannah River include the American shad, hickory shad, channel catfish, white catfish (Marcy et al. 2005), and American eel (GDNR

2007b). A fishery also existed previously for the Atlantic sturgeon; however, all Atlantic coastal states have enacted a closure or moratorium on the harvest of Atlantic sturgeon. Although no herring are taken in Georgia because of netting restrictions, a commercial blueback herring fishery formerly existed in South Carolina portions of the Savannah River (Marcy et al. 2005). Sport fishermen are the principal consumers of fish from the middle Savannah River. The fishes principally harvested include largemouth bass, black crappie, sunfishes (*Lepomis* spp.), American shad, chain pickerel, larger catfishes such as white and channel catfish, and striped bass and its hybrids. The striped bass is classified as a game fish in South Carolina and Georgia, and no commercial striped bass fishery is allowed in the Savannah River (Marcy et al. 2005).

Georgia has issued advisories for the Savannah River above and below the New Savannah Bluff Lock and Dam (located south of Augusta) that recommend a limit of one meal per week of largemouth bass and spotted sucker due to risk from mercury. In addition, Georgia has issued a special advisory for the Savannah River from the New Savannah Bluff Lock and Dam downstream to the estuary, recommending a limit of one meal per month of striped bass 27 inches and greater in length due to risk from mercury, noting that small children and women who are pregnant or nursing may want to further limit their consumption of striped bass from this area (GDNR 2007c).

South Carolina has issued advisories for the Savannah River from Stevens Creek in Edgefield County north of Augusta to Jasper County in the Coastal Plain. The advisories are due to mercury risk, and South Carolina also notes that some fish in the Savannah River contain the radionuclides cesium-137 and strontium-90. The species affected and consumption recommendations are the following: bowfin – do not eat, largemouth bass – one meal per month, and chain pickerel and spotted sucker – one meal per week (SCDHEC 2007).

Invertebrate Community

As discussed above, the invertebrate community and other aquatic resources of the middle Savannah River basin have been characterized by numerous studies, the most comprehensive of which is documented in the series of reports by the ANS. The latest invertebrate surveys with results reported by the ANS, which included samples from stations upstream and downstream of VEGP, were performed in the fall of 2001 (ANS 2003).

<u>Aquatic Insects</u>

Aquatic insect abundance and diversity are particularly useful bioindicators of water quality. Aquatic insects are abundant, have limited mobility and relatively long life spans, and their responses to environmental changes can be easily measured and analyzed (ANS 2003). The ANS long-term monitoring survey on the Savannah River, upstream and downstream of VEGP, shows a trend of increasing abundance of aquatic insects beginning in the early 1980s (Wike et al. 2006) as well as increased taxa richness (SNC 2007a). Biodiversity (number of species) was greater downstream of SRS (and VEGP) than upstream (Wike et al. 2006), and the number of pollutant-tolerant species was greater upstream, suggesting higher water quality downstream of SRS and VEGP than in the vicinity of the upstream cities of Augusta and North Augusta (SNC 2007a).

ANS investigations in 2001 of insect species composition provided results similar to previous years, with the dipterans (47 taxa), beetles (28 taxa), dragonflies and damselflies (15 taxa), mayflies (17 taxa), and caddisflies (14 taxa) being the most species-rich groups (ANS 2003). Overall, the natural spatial variation found in all rivers and streams was considered to explain the detected differences among sites that were found in the 2001 aquatic insect study (ANS 2003). Statistical analyses of the quantitative samples revealed that the condition of aquatic insect assemblages at stations potentially exposed to the influences of SRS and VEGP tended to be at least as good as conditions at the reference station situated upstream of the SRS and VEGP (ANS 2003). Studies conducted in 1999 and 2000 reported similar conclusions. The 2001 ANS biomonitoring study concluded that the biological communities in the Savannah River were not being impacted, either by the SRS or VEGP (ANS 2003).

<u>*Non-Insect Macroinvertebrates*</u>

The Savannah River is characterized by the presence of four dominant non-insect macroinvertebrate groups; bivalves, snails, crustaceans, and leeches (ANS 2003). The 2001 ANS study (ANS 2003) reported fewer species in the four dominant non-insect macroinvertebrate groups, as well as fewer species overall, were collected compared to studies conducted in the mid to late 1990s. This trend first became evident in 1999 and may be attributable to drought conditions in the basin and subsequent lower flows in the Savannah River (ANS 2003). Other possible contributing factors are the reduced number of sampling stations after 1998 and the use of quadrat sampling for mussel collection in 2000 and 2001 (ANS 2003).

A good deal of information is provided in the 2001 ANS study on the abundance or diversity of Annelids (in particular, leeches) in the Savannah River. In 2001, 5 species of leeches were collected (from stations 1 and 6 only); not counting at least one additional unidentified species that was collected from station 5. This total of 6 leech species matches the most taxa ever collected during a study, with the exception of the 1972 study in which 10 leech taxa were observed, due to areas of submerged aquatic vegetation (ANS 2003).

Three species of crustaceans were found in the Savannah River in 2001: a crayfish (*Procambarus enoplosternum*), a riverine grass shrimp (*Palaemonetes paludosus*), and an amphipod (*Hyalella azteca*; ANS 2003). These three species of crustaceans, which prefer a variety of habitats such as root mats, logs, alligator weed, and leaf litter, were all present at stations 1 (upstream reference) and 6 (farthest downstream) (ANS 2003). Four crustacean taxa were collected in 2000; the three collected in 2001 plus an unknown amphipod species of the genus *Gammarus*. The mean number of crustacean taxa calculated from values of crustaceans collected at four Savannah River stations was 5.1, and the range in the number of crustacean taxa from previous studies was 4 to 7 (ANS 2003).

Molluscs

Four locations on the Savannah River were sampled for molluscs during the most recent ANS study, one upstream from VEGP, one immediately downstream of VEGP, and two farther downstream. An average 7.6 snail species were collected in each study that was conducted from 1972 to 2000. Nine species were collected (from stations 1 and 6 only) in 2001, second only to the 10 species collected in 1997 and the 11 collected in 1972. The high number of snail taxa observed in 1972 coincided with a eutrophic period with increased numbers of submerged vascular plants (ANS 2003). Bivalves found near VEGP include mussels, fingernail clams, peaclams, and the Asian clam (*Corbicula fluminea*; ANS 2001).

Given that mussels are considered the most endangered invertebrate group in North America (Williams et al. 1993), the survey in August 2001 was entirely devoted to mussel fauna. Quadrat sampling was used in place of the comprehensive, qualitative hand collections of earlier studies and, as a result, fewer mussels were collected in 2000 and 2001 compared to previous studies (ANS 2003). Fewer taxa were collected in 2001 compared to earlier studies (1993 to 1999), and this decline in diversity may be related to drought conditions in the basin (since June 1998) and the resultant low-flow condition of the Savannah River (ANS 2003). Early studies (1951 to 1968) found the Carolina slabshell (*Elliptio congarea*), eastern elliptio (*Elliptio complanata*), Altantic spike (*Elliptio producta*), variable spike (*Elliptio icterina*), yellow lamp mussel (*Lampsilis cariosa*), and rayed pink fatmucket (*Lampsilis splendida*) to be the most abundant species (ANS 2001). Hand collections during the August to October period from 1972 to 2000 revealed an average of 11 species of mussels were collected per survey (ANS 2003). Of the 16 different mussel species that were collected between 1951 and 2000, none was a Federally or State listed species.

According to the 2000 ANS survey (ANS 2001), the Savannah River mussel community experienced several changes from 1951 to 2000 including differing taxa dominance from year to year, an increasing presence of "hardier forms," and a scarcity of juvenile mussels. It has been hypothesized that construction-related changes in the flow of the Savannah River and increased competition from the non-native Asian clam contributed to these changes (ANS 2001).

There is no question that the introduction of the Asian clam has adversely affected the mussel community. Surveys by the ANS show the presence of this non-native clam at all sample stations by 1976. Widely abundant and able to utilize a variety of substrates in the Savannah River, the Asian clam comprised 96 to 98 percent of the bivalves collected (ANS 2001). Of the 1877 molluscs collected in 2001, 85 percent were Asian clams. These data indicate that the numerical dominance of the Asian clam in macrobenthic habitats of the Savannah River has been affecting the mussel fauna of the river by competing for space and food resources (ANS 2001).

Plant Community

As discussed above, the aquatic plant community and other aquatic resources of the middle Savannah River basin have been characterized by numerous studies, the most comprehensive of which is documented in the series of reports by the ANS. The latest plant surveys with results reported by the ANS, which included samples from stations upstream and downstream of VEGP, were performed in 2003. Much of the aquatic flora of riverine systems is comprised of algae and macrophytes, which make up the base of an aquatic ecosystem's food web and provide shelter and habitat for aquatic fauna. Attached algae and aquatic macrophytes were collected by hand from natural substrates as part of the ANS surveys through 2001 (ANS 2003). The Savannah River, with reaches in the vicinity of SRS and VEGP, is a deep and relatively swift river that does not provide substantial habitat for macrophyte beds of notable area or biomass (Wike et al. 2006), and no significant beds of submerged aquatic vegetation were observed in the ANS studies (ANS 2003).

In most aquatic systems, diatoms (algae with cell walls of silica) are the most common type of attached algae (periphyton) and can be used as bioindicators of adverse impacts on water quality. The ANS studies have included since 1951 investigations of diatom diversity, richness and evenness in the river. The water quality upstream and downstream of VEGP is assessed based on comparison of diatom assemblages (ANS 2003). In recent years, diatoms were generally the most abundant algal group collected in the river. The dominant diatom species generally were *Melosira varians*, which is tolerant of pollution, and *Gomphonema parvulum*, which is common in the presence of organic pollution. Other commonly found diatoms included *Nitzschia kuetzingiana, Cymbella minuta, Eunotia pectinalis* v. *undulata, Navicula neoventricosa, Navicula pelliculosa, Achnanthes biporoma*, and *Navicula confervacea* (Wike et al. 2006).

In general, diatom assemblages at all stations exhibited similar species composition and pollution tolerance. Nutrient enrichment, likely from sources upstream of VEGP, was evident at all stations, and diatom flora did not differ significantly among the downstream stations (ANS 2003). The 2003 diatom study found that the diatom assemblages upstream (Station 1) and downstream of SRS and VEGP (Station 6) were similar, including the dominance of a few species of *Gomphonema* and the low abundance of the majority of species. Ecological tolerances of the diatom species found were similar for the dominant species at both stations.

Nearly all of the dominant diatom species found historically in the Savannah River in the vicinity of SRS and VEGP have been characteristic of alkaline waters with moderately high nutrient concentrations (ANS 2005).

The most common algae collected in the ANS studies other than diatoms include the green algae *Oedogonium* sp., *Stigeoclonium lubricum*, which is associated with pollution, *Closterium moniliferum, Spirogyra* sp. and *Mougeotia* sp.; the blue-green algae *Schizothrix calcicola, Microcoleus vaginatus, Schizothrix arenaria, Porphyrosiphon splendidus, Schizothrix friesii,* and *Microcoleus lyngbyaceus*, many of which are associated with pollution; the yellow-green algae *Vaucheria* sp.; and the red algae *Audouinella violacea, Compsopogon coeruleus*, and *Batrachospermum* sp. The number of recorded species other than diatoms ranged from 7 to 19 from 1985 through 1995. At all stations, the average numbers of species were greater during the fall surveys than the spring surveys (Wike et al. 2006).

In general, the algal community of the middle Savannah River has remained fundamentally similar through the ANS surveys since 1951. Algal growth in recent years has been light to moderate at all stations. The dominant algae are species characteristic of moderate to high nutrient levels and typical of southeastern coastal plain rivers. Algae at the upstream station and stations downstream of SRS and VEGP showed evidence of organic pollution, apparently from an upstream source. Study results have showed no evidence of an adverse impact on algal community due to SRS or VEGP operations (Wike et al. 2006).

2.2.5.2 Beaverdam Creek

Beaverdam Creek is a 6-mi-long, blackwater creek that is located just south of the site boundary. It drains much of area south and west of the VEGP facility and enters the Savannah River approximately 2 miles downstream of the intake structure. Two studies evaluated the fish community of Beaverdam Creek in 1977 and 1978 to assess the effects of the construction of VEGP on resident fish populations and on anadromous fish that spawn in the creek. The study of resident fish in the creek collected 2435 fish representing 39 species. Collections were dominated by minnows, sunfish, and darters, principally the dusky shiner, bluegill, mosquitofish, and blackbanded darter *(Percina nigrofasciata)*. These four species made up 68 percent of all fish collected during the study. The Savannah darter *(Etheostoma fricksium)* was also observed in smaller numbers (31 individuals in a 2-year period) (Wiltz 1982a). The study of anadromous fish collected 674 individual fish (including eggs and larvae) from 29 species in Beaverdam Creek and concluded that the creek was a minor contributor to spawning of blueback herring (*Alosa aestivalis*). Although the habitat was suitable for hickory shad (*Alosa mediocris*), only 17 individuals were found, and none were observed spawning (Wiltz 1982b). No further studies have been conducted on Beaverdam Creek since the late 1970s.

2.2.5.3 Water Bodies in Transmission Line ROWs

The transmission lines within the six ROWs associated with the VEGP site cross numerous water bodies that provide a variety of aquatic habitats from the Piedmont to the Coastal Plain (see Section 2.1.7 and Figure 2-4). The SCE&G line crosses the Savannah River, which is discussed in detail above. The Goshen, Augusta Newsprint, and Wilson lines do not cross any notable water bodies. The two longest VEGP transmission lines, the Scherer line and the West McIntosh (Thalmann) line, cross several major rivers, a lake, and many smaller water bodies, and are further discussed below.

The Scherer transmission line is approximately 154 mile long, and its ROW is mainly 150 feet wide but up to 400 feet wide in some locations. The Scherer line runs west from VEGP and crosses Brier Creek and surrounding forested wetlands (USGS 2007e and Trails.com 2007) in Burke County and the Ogeechee River in Jefferson County. It then runs northwest and crosses the Oconee River in the area of Lake Sinclair on the border of Hancock and Putnam Counties. From there, it runs generally southwest and crosses the Ocmulgee River approximately 0.5 miles south of Zellner Island in Monroe County before terminating at Plant Scherer (USGS 2007e).

The West McIntosh (Thalmann) line is nearly 150 mile long, and its ROW is 150 feet wide. This line runs south-southeast from VEGP until it nears the Savannah River in Screven County. There it turns south and crosses Brier Creek upstream of its confluence with the Savannah River and continues southeast to the West McIntosh Substation in Effingham County. The Thalmann portion of the line runs southwest as it leaves the substation and generally continues in this direction until it terminates at the Thalmann Substation in Glynn County. As this line runs southwesterly along the Coastal Plain, it crosses multiple creeks and swamps and the Altamaha River near the convergence of McIntosh, Wayne, and Glynn Counties. The Altamaha River is the largest river of the Georgia coast (Georgia Rivers LMER 2007).

Marcy et al. (2005) compared the aquatic communities of the Savannah River system to the Ogeechee-Altamaha River system. The Ogeechee and the Altamaha, like the Savannah, drain the Piedmont and Coastal Plain of Georgia. A species similarity index of nearly 71 percent was calculated (Marcy et al. 2005), indicating a substantial degree of similarity between the aquatic communities of the Ogeechee and Altamaha River systems and the aquatic community of the Savannah River described above.

2.2.5.4 Protected Aquatic Species

Aquatic species that are Federally listed as endangered or threatened or State-listed and legally protected in Georgia or South Carolina and have been recorded as occurring on or in the vicinity of the VEGP site are identified in Table 2-8. This table includes Federally listed or Georgia

State listed species with recorded occurrences in Burke County within approximately 10 miles of the site (GDNR 2008) and Federally listed or South Carolina State-listed species occurring within approximately 10 miles of the site in Aiken or Barnwell Counties (SCDNR 2008). The Federally or State-listed species with recorded occurrences in the counties crossed by the existing transmission line ROWs beyond 10 miles of the site are identified in Table 2-9, based on the lists for each of the 18 counties (GDNR 2007d, SCDNR 2007). Omitted from the table are marine species (whales and sea turtles) that would not occur in the inland areas where the ROWs are located. Both tables show for each species the counties in which the species occurs and the listing status of the species in that state. There are no designated or proposed critical habitats for aquatic Federally listed species on or in the vicinity of the VEGP site or the transmission line ROWs (SNC 2007b).

Table 2-8. Federally and State Listed Aquatic Species with Recorded Occurrences in the Vicinity of the VEGP Site [(a)]

Scientific Name	Common Name	Federal Status [(b)]	State Status [(c)]	County of Occurrence
Fish				
Acipenser brevirostrum	shortnose sturgeon	FE	SE	Burke
Moxostoma robustum	robust redhorse		SE	Burke[(d)]
Invertebrates				
Anodonta couperiana	barrel floater		SC	Barnwell (SC)
Elliptio congaraea	Carolina slabshell		SC	Barnwell (SC)
Fusconaia masoni	Atlantic pigtoe		SE	Burke
Lampsilis cariosa	yellow lampmussel		SC	Barnwell (SC)
Lampsilis splendida	rayed pink fatmucket		SC	Barnwell (SC)
Pyganodon cataracta	eastern floater		SC	Barnwell (SC)
Toxolasma pullus	Savannah lilliput		ST, SC	Burke, Barnwell (SC)[(e)]
Utterbackia imbecillis	paper pondshell		SC	Barnwell (SC)

(a) Occurrences considered in the vicinity are within approximately 10 miles of the VEGP site in Burke County, Georgia, or Barnwell or Aiken Counties, South Carolina (SC). State occurrence data and distances obtained from GDNR (2008) and SCDNR (2007a, 2008) unless noted otherwise.
(b) Federal listing status definitions: FE = Endangered (FWS 2004)
(c) State listing status definitions: SE = State Endangered, ST = State Threatened, SC = Species of Concern in South Carolina (GDNR 2008; SCDNR 2007)
(d) The robust redhorse has been found in the Savannah River near the VEGP site (RRCC 2008).
(e) The Savannah lilliput has been found in the Savannah River near the VEGP site (ANS 2003).

Table 2-9. Federally and State Listed Aquatic Species with Recorded Occurrences in the Counties Crossed by the Transmission Line ROWs [a]

Scientific Name	Common Name	Federal Status [b]	State Status [c]	County of Occurrence
Plants				
Amphianthus pusillus	pool sprite	FT	ST	Hancock, Putnam
Eleocharis robbinsii	Robbins spikerush		SC	Barnwell (SC)
Eleocharis tricostata	three-angle spikerush		SC	Barnwell (SC)
Isoetes tegetiformans	mat-forming quillwort	FE	SE	Hancock, Putnam
Ptilimnium nodosum	harperella	FE	SE	Barnwell (SC)
Utricularia floridana	Florida bladderwort		SC	Barnwell (SC)
Utricularia olivacea	Piedmont bladderwort		SC	Barnwell (SC)
Vallisneria americana	eelgrass		SC	Barnwell (SC)
Mammals				
Trichechus manatus	West Indian manatee	FE	SE	Bryan, Chatham, Effingham, Glynn, Liberty, McIntosh
Fish				
Acipenser brevirostrum	shortnose sturgeon	FE	SE	Bryan, Burke, Chatham, Glynn, Long, McIntosh, Screven
Cyprinella xaenura	Altamaha shiner		ST	Jones, Monroe, Putnam
Elassoma okatie	bluebarred pygmy sunfish		SE	Richmond
Etheostoma parvipinne	goldstripe darter		SR	Jones
Lucania goodie	bluefin killifish		SR	McIntosh
Moxostoma robustum	robust redhorse		SE	Baldwin, Hancock, Putnam, Washington
Invertebrates				
Alasmidonta arcula	Altamaha arcmussel		ST	Long
Anodonta couperiana	barrel floater		SC	Barnwell (SC)
Cambarus truncatus	Oconee burrowing crayfish		ST	Washington
Elliptio congaraea	Carolina slabshell		SC	Barnwell (SC)
Elliptio spinosa	Altamaha spinymussel	FC	SE	Long, McIntosh
Fusconaia masoni	Atlantic pigtoe		SE	Burke, Jefferson, Richmond, Screven

Table 2-9. (cont'd)

Scientific Name	Common Name	Federal Status [(b)]	State Status [(c)]	County of Occurrence
Lampsilis cariosa	yellow lampmussel		SC	Barnwell (SC)
Lampsilis splendida	rayed pink fatmucket		SC	Barnwell (SC)
Pyganodon cataracta	eastern floater		SC	Barnwell (SC)
Utterbackia imbecillis	paper pondshell		SC	Barnwell (SC)
Villosa delumbis	eastern creekshell		SC	Barnwell (SC)
Villosa vibex	southern rainbow		SC	Barnwell (SC)

(a) Counties crossed by ROWs include: Baldwin, Bryan, Burke, Chatham, Effingham, Glynn, Hancock, Jefferson, Jones, Liberty, Long, McIntosh, Monroe, Putnam, Richmond, Screven, and Washington in Georgia; and Barnwell in South Carolina (SC). Marine species (whales, sea turtles) that would not occur in the inland areas where the ROWs are located were omitted. State occurrence data obtained from GDNR (2008) and SCDNR (2007a). Federal occurrence data obtained from FWS (2004) and SCDNR (2007a).

(b) Federal listing status definitions: FE = Endangered, FT = Threatened, FC = Candidate species (FWS 2004)

(c) State listing status definitions: SE = State Endangered, ST = State Threatened, SR = State Rare, SC = Species of Concern (GDNR 2008; SCDNR 2007)

2.2.5.4.1 Site Vicinity

The only Federally listed aquatic species with recorded occurrences in the vicinity of the VEGP site is the shortnose sturgeon, which inhabits the Savannah River (NMFS 1998; NRC 2007). In addition, there are two aquatic species that are State-listed as endangered or threatened and known to occur in the vicinity of VEGP, the robust redhorse (*Moxostoma robustum*) and the Savannah lilliput (*Toxolasma pullus*). These three species are described below.

<u>Shortnose Sturgeon</u>

The shortnose sturgeon is a member of the Family Acipenseridae, an ancient group of long-lived, anadromous and freshwater fishes. The shortnose sturgeon is an anadromous fish that spawns in large Atlantic coastal rivers of eastern North America from New Brunswick, Canada, to northern Florida. It is the smallest of the three sturgeon species that occur in eastern North America, reaching maturity at fork lengths of 18 to 20 inches and having a maximum total length of approximately 4 feet and a weight of up to 50 pounds (lbs). Shortnose sturgeon grow slowly, reach sexual maturity late in life, and most live 15-20 years (longevity record was 67 years). The shortnose sturgeon was a species of commercial importance around the turn of the century, and it was commonly taken in the fishery for the closely related and more commercially valuable Atlantic sturgeon and as bycatch in the shad fishery. The substantial decline in shortnose sturgeon populations has been attributed to overfishing as well as the impoundment of rivers and water pollution, and the species now is endangered. Natural recruitment rates appear to be too low to replenish depleted populations (NMFS 1998, NOAA 2007, Marcy et al. 2005).

The shortnose sturgeon was originally listed by FWS as an endangered species under the Endangered Species Preservation Act (32 FR 4001) in 1967. That act was the predecessor of the ESA of 1973 (16 USC 1531) under which the sturgeon currently is protected. NMFS assumed jurisdiction over the shortnose sturgeon in 1974. NMFS is the agency responsible for most anadromous and marine species under the ESA. Although the shortnose sturgeon was originally listed as endangered throughout its range, NMFS currently recognizes 19 distinct populations occurring in 19 different river systems from New Brunswick, Canada, to northern Florida. Life history studies indicate that populations from these river systems are substantially isolated reproductively and should be considered discrete. NMFS has determined that the loss of a single shortnose sturgeon population constitutes the permanent loss of unique genetic information that is potentially critical to the survival and recovery of the species. Accordingly, the species is managed based on protection of the distinct population segments in each of these river systems, including the Savannah River (NMFS 1998).

Shortnose sturgeon spend most of their lives in their natal river systems and only rarely enter the ocean. The species is estuarine anadromous in the southern part of its range. Thus, adult shortnose sturgeon in the Savannah River forage near the freshwater-saltwater boundary in the estuary throughout the year except during spawning runs, when they migrate upstream from late January to March. Most adults return to the lower river by early May. Probable spawning sites in the Savannah River were identified by monitoring the movement of adult shortnose sturgeon and identifying reaches that repeatedly were the destinations of migrating adult fish and that were occupied for several days during the spawning season (Meyer et al. 2003). The probable spawning sites are in sharp curves of the channel over substrates of rocks, gravel, sand, and logs in two principal reaches: from RM 111 to 118 and from RM 170 to 172 (NMFS 1998, Meyer et al. 2003). The VEGP site adjoins the Savannah River between RM 150 and 152, an area that has not been identified as a known or suspected spawning site.

Spawning occurs usually during peak flood tide in February or March in or adjacent to deep areas of the river with significant currents when water temperatures are between 50 and 62°F (9.8 and 16.5°C). Adults spawn at 2- to 5-year intervals. Fertilized eggs are heavier than water (demersal) and extremely adhesive after fertilization, sinking quickly and adhering to hard substrates such as rocks and logs. Eggs hatch in 1 to 2 weeks. Larvae and early juveniles are weak swimmers; they stay near the bottom for about 2 weeks drifting with the current, then slowly migrate downstream (Marcy et al. 2005). When they reach the estuary, juveniles remain in the reach between RM 29 and 19 near the saltwater-freshwater interface, moving into the upstream area in summer and the downstream area in winter (Meyer et al. 2003). The age of sexual maturity appears to be 8 to 15 years in the north and younger in the south. The diet of juvenile shortnose sturgeon is mainly aquatic insects and small crustaceans, while adults feed primarily on molluscs but also consume insects and crustaceans (Marcy et al. 2005).

As part of a state/federal recovery program, over 97,000 hatchery-spawned shortnose sturgeon (18 percent of which were tagged) were stocked in the Savannah River between 1984 and 1992, and many were recaptured (Marcy et al. 2005). Over 35 percent of juvenile shortnose sturgeon captured in the Savannah River from 1990 to 1993 were identified as stocked fish (Wike 1998). Based on records of marked fish and results from tagging studies, it was estimated that 38 percent of the adult population in the Savannah River during the 1997 to 2000 time frame consisted of stocked fish (Marcy et al. 2005). These findings indicate that recruitment into the local population was occurring (Wike 1998). The most recent estimate (in 1999) of the shortnose sturgeon population of the Savannah River was 3000 fish (NMFS 2006).

Robust Redhorse

The robust redhorse is a member of the sucker family, Catostomidae. It is State-listed in Georgia as endangered and has no legal status in South Carolina. It was first described in 1870 based on a specimen collected in North Carolina. Subsequently, the species remained essentially unknown and was presumed extinct for more than 120 years until a population was discovered and identified in 1991 in the Oconee River in central Georgia. Since then, wild populations have been found in the Savannah River, the Ocmulgee and Oconee rivers in Georgia, and the Pee Dee River in South and North Carolina (Robust Redhorse Conservation Committee [RRCC] 2008). The robust redhorse is the largest sucker species in North America (FWS 2001a). Its average adult size is 25 inches in length and 9 lbs in weight, though it can reach 30 inches and 17 lbs. It is is long-lived, with a maximum known age of 27 years (RRCC 2008). It uses large, molar-like pharyngeal teeth to crush its prey of mussels and clams. Its habitat is rivers. Non-spawning adults occur primarily in deep areas with moderate current and in association with tree snags and woody debris near shore. Spawning takes place in swift current where the substrate is coarse gravel (RRCC 2008; Self and Bettinger 2006). Efforts to estimate the size of the Savannah River population of the robust redhorse are ongoing, but the population seems to be substantial (Self and Bettinger 2006). In 1997, a single adult was collected from the Savannah River near VEGP (Hendricks 2000). Surveys subsequently found a population in the Savannah River near Augusta, Georgia, and at numerous locations between Augusta and U.S. Highway 301, which crosses the river approximately 20 mi southeast of VEGP. Spawning locations have been identified near Augusta (Hendricks 2002). A study in the Savannah River found that the robust redhorse moved an average of at least 24 km (15 mi) per season. These migrations generally were downstream except in the spring and were related to seasonal changes in water temperature. The upstream migrations to spawning areas in spring began when the water temperature reached about 12°C (54°F). Tracking of daily movements found that the robust redhorse is active mainly during the day and uses a limited area within approximately a 1 km (0.6 mi) reach of the river (Grabowski and Isely 2006).

Savannah Lilliput

The Savannah lilliput is State-listed as threatened in Georgia and as a species of concern in South Carolina. It is a small mussel that occurs in shallow water habitats, usually in silty sand or mud near the margins of rivers, streams, and lakes. Occurrences have been reported from the Neuse River in North Carolina to the Altamaha in Georgia, but only a few disjunct populations remain within this range. The Savannah River population extends several miles along the river and may be the largest population (NatureServe 2007). Its presence has been documented in the reach of the river adjacent to VEGP and SRS (ANS 2003).

2.2.5.4.2 Transmission Line ROWs

The Federally listed aquatic species with recorded occurrences in at least one of the 18 counties crossed by the transmission line ROWs include three plants, one mammal, and the shortnose sturgeon. The listed aquatic plants are the threatened pool sprite (*Amphianthus pusillus*) and the endangered mat-forming quillwort (*Isoetes tegetiformans*) and harperella (*Ptilimnium nodosum*). The aquatic mammal is the endangered West Indian manatee (*Trichechus manatus*). The endangered shortnose sturgeon, which is discussed above based on its occurrence in the Savannah River near the VEGP site, also occurs in other rivers that are crossed by the West McIntosh (Thalmann) line, the Ogeechee and Altamaha Rivers (NMFS 1998).

In addition, a mussel occurring in two of the counties is a candidate for listing. The Altamaha spinymussel (*Elliptio spinosa*) occurs in the Altamaha River in Long and McIntosh Counties, which are crossed by the West McIntosh (Thalmann) line. The southern borders of these counties follow the channel of the river.

2.2.6 Terrestrial Resources

2.2.6.1 Terrestrial Resources at the VEGP site

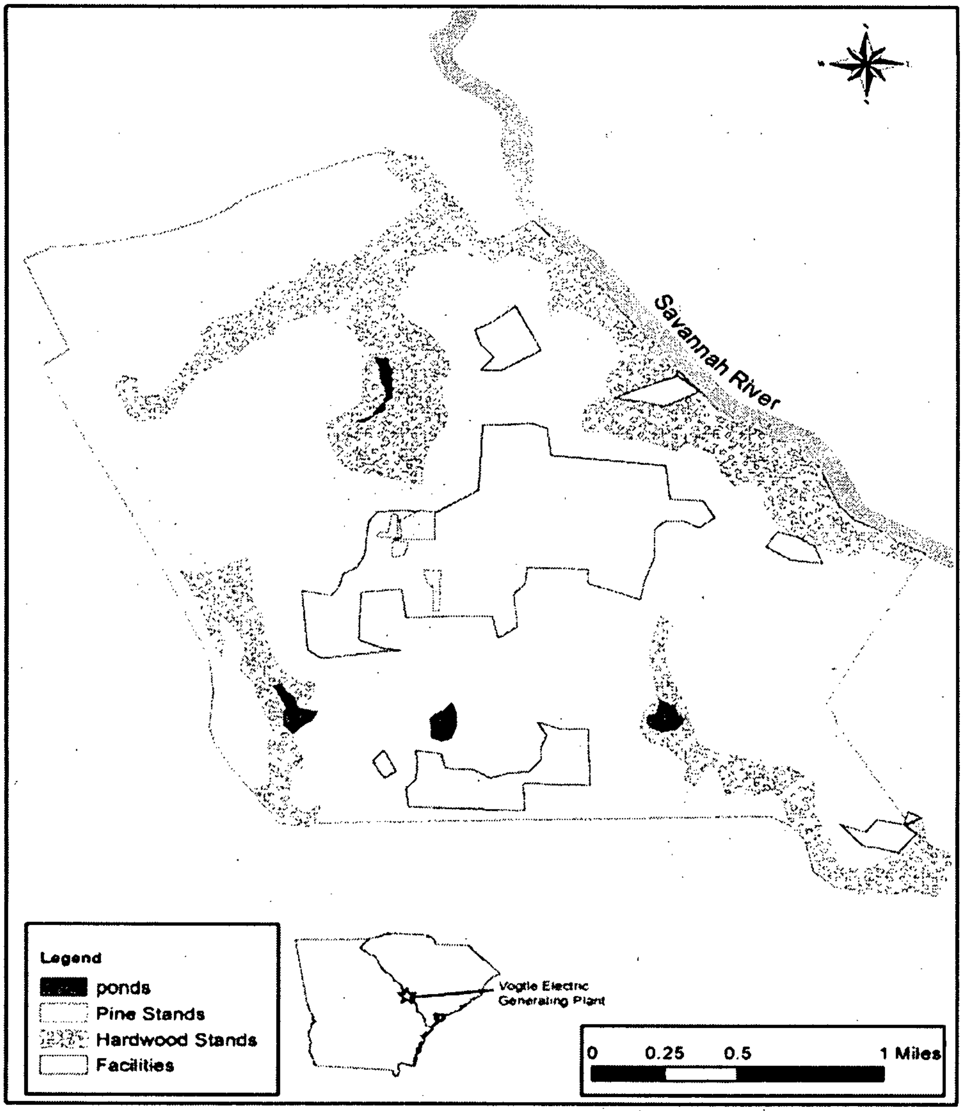
The VEGP site (and its associated transmission lines) is within the Atlantic Coastal Plain 25 mi (40 km) east of the Piedmont and 30 mi (48 km) south of the Fall Line. The overall terrain of the VEGP site consists of low, rolling, mostly sandy hills with the minimum elevation occurring along the Savannah River at 80 ft (24 m) above mean sea level (msl) and a maximum elevation of 280 ft (85 m) above msl along the hilltops (SNC 2007a). The entire VEGP site encompasses 3169 ac (1282 ha) (SNC 2007a). The buildings associated with generation and maintenance, parking lots, and on-site roads, occupy approximately 1400 ac (567 ha) of the overall site. The remaining 1769 ac (716 ha) are covered mainly by pine and hardwood dominated forests (SNC 2007a). Terrestrial resources found within the VEGP site and associated transmission line ROWs include the upland, riparian, and bottomland forest communities, as well as ponds, streams, and wetlands. Included are descriptions of the characteristic flora and fauna of these communities as well as the rare species that may occur there.

GPC manages several wildlife strategies at the VEGP site. These strategies seek to promote diverse habitats, manage pine tree species populations through thinning and burning, and maintain wildlife food plots. The VEGP has been designated a Certified Wildlife Habitat by the Wildlife Habitat Council (WHC), a non-profit organization. To maintain this designation, GPC employs a continuous wildlife habitat maintenance program that is certified by the WHC every 3 years (SNC 2007a). GPC also manages wildlife habitat within some of the transmission line ROWs by employing a GDNR program called Wildlife Incentive for Non-Game and Game Species (WINGS). This program aims to assist private land owners in the conversion of transmission line ROWs into wildlife habitat areas.

Pre-settlement vegetation at the VEGP site and its associated transmission lines consisted of pine and oak forested land with isolated streams, ponds, and wetlands. After the construction of the VEGP site, much of the forested areas were disturbed to provide room for the plant facilities. Some of the site has returned to forested areas while the transmission line ROWs require continual maintenance to prevent damage to the lines.

Upland areas of the VEGP site support terrestrial forests of pine, oak, hickory, and other hardwoods, as well as harvesting pine plantations. The Bluffs on the VEGP site separate the upland forested areas from the areas in the floodplain of the Savannah River. The low areas of the VEGP site along the streams and the Savannah River floodplain support bottomland hardwood forests and wetlands (NRC 2007). Most wetlands occur in conjunction with waterbodies such as streams, rivers, and ponds. In some open areas disturbed by the removal of forest and construction of the VEGP site, grasses and the herb sericea lespedeza (*Lespedeza cuneata*) were planted to prevent erosion (SNC 2006e). Figure 2-8 is a map of the terrestrial plant communities and ponds on the site.

The two main types of upland forest communities on the VEGP site are identified by their dominant species; the longleaf pine (*Pinus palustris*) - scrub oak community and the oak - hickory community. The longleaf pine - scrub oak community is found on ridge tops as well as slopes to the south and west in undisturbed areas. Common canopy species in addition to longleaf pine are scrub oaks such as turkey oak (*Quercus laevis*) and bluejack oak (*Quercus incana)*. The shrub layer in the longleaf pine - scrub oak community include sparkleberry *(Vaccinium arboreum),* dwarf huckleberry (*Gaylussacia dumosa*), and yellow jessamine *(Gelsemium sempervirens)*. Herbaceous ground cover diversity varies with canopy closure. In the most shaded region of the community, only clumps of slender woodoats *(Chasmanthium laxum)* are present. In the communities more open areas, gopher weed *(Baptisia perfoliata),* jointweed *(Polygonella americana),* tread-softly *(Cnidoscolus stimulosus),* and reindeer lichen *(Cladina rangiferina)* are present. The oak – hickory community is found on both the north and



Source: SNC 2007a

Figure 2-8. Vegetation Communities and Ponds on the VEGP Site east slopes in the undisturbed uplands. The canopy of this community is comprised mainly of white oak (*Quercus alba*) and mockernut hickory *(Carya alba)*. White ash *(Fraxinus americana)*, flowering dogwood *(Cornus florida)*, and a few turkey oaks and shortleaf pines *(Pinus echinata)* are also present (TRC 2006).

The VEGP site allocates 350 ac (142 ha) of land to the Georgia Power Company (GPC) to the development of pine plantations. The GPC is solely responsible for the management and maintenance of the VEGP pine plantations. There are many plantations within the land allotted to pine tree development that are varied in both number of trees and tree density to land ratio. In addition, the plantations vary in pine tree species. The primary pine species include: slash pine (*Pinus elliottii*), loblolly pine (*Pinus taeda*), and longleaf pine. The ground cover within the plantations is largely grasses and brachen fern *(Pteridium aquilinum)*. Where plantations are less densely populated with pines, there are vast open areas that contain: dog fennel *(Eupatorium capillifolium)*, broomsedge *(Andropogon virginicus)*, and blackberry bushes (*Rubus* spp.). The plantations populated by longleaf pine are neither cut nor burned so that they may be similar to the 60 to 100 year old native longleaf pines that once grew at this location. The remaining plantations are managed through prescribed burns, cutting, and trimming. Burning occurs on a 3 to 5 year cycle and is limited to 25 to 30 percent of the total remaining pine population (not to include longleaf pines) (TRC 2006; SNC 2006e).

On the VEGP site, river bluff forests separate the upland forest areas from the intermittently flooded lowland and riparian forested areas. The bluff forests have some of the largest trees on site, with diameters exceeding 3 ft (0.9 m). Common larger trees are oaks, mockernut hickory, American elm *(Ulmus americana)*, basswood *(Tilia americana)*, and Florida maple *(Acer barbatum)*. Smaller trees common to bluff forests are tuliptree *(Liriodendron tulipifera)*, sweetgum *(Liquidambar styraciflua)*, and pawpaw *(Asimina triloba)*. The common shrubs, vines and bushes are hophornbeam *(Ostrya virginiana)*, American beautyberry *(Callicarpa americana)*, muscadine *(Vitis rotundifolia)*, crossvine *(Bignonia capreolata)*, and poison ivy *(Toxicodendron radicans)*. Herbaceous ground cover varies with the soil of the moisture. Christmas fern *(Polystichum acrostichoides)* and white snakeroot *(Ageratina altissima)* are common in the drier areas while mottled trillium *(Trillium maculatum)*, wild ginger *(Asarum canadense)*, false nettle *(Boehmeria cylindrica)*, and jewelweed *(Impatiens capensis)* are common in steeps and other wetter areas (TRC 2006).

Riparian forests on the VEGP site lie along the Savannah River on the eastern side of the property boundary. Due to the proximity of the forest to the river, riparian forests have large variations in wetness and soil moisture. Water tupelo (*Nyssa aquatica*) and bald cypress (*Taxodium distichum*) are common in the wetter areas, usually closer to the Savannah River. American sycamore *(Platanus occidentalis)*, boxelder *(Acer negundo)*, sugarberry *(Celtis laevigata)*, and swamp chestnut oak *(Quercus michauxii)* occupy the drier areas, usually further from the Savannah River. Common bushes and shrubs include American holly (*Ilex opaca*), ironwood *(Carpinus caroliniana),* water locust *(Gleditsia aquatica),* giant cane *(Arundinaria gigantea),* and buttonbush *(Cephalanthus occidentalis).* Herbaceous ground cover is sparse and common species include richweed *(Pilea pumila),* lizard's tail *(Saururus cernuus),* sensitive fern (*Onoclea sensibilis),* and Virginia dayflower (*Cornmelina virginica*). These species tend to be very water tolerant and can survive in shaded areas (TRC 2006).

There are six perennial streams, 13 intermittent streams, three ephemeral streams, and several ponds on the VEGP site (Eco-Sciences 2007). Mallard Pond is a 5-ac (2-ha) pond in a hardwood cove on the site just northwest of the switchyard. It was on the VEGP site prior to construction and is man-made. The small, unnamed creek that drains Mallard Pond flows north then east into the Savannah River at Hancock Landing, approximately 0.6 mi (1 km) upstream of the intake structure. The creek is approximately 2 to 4 feet (0.6 to 1.2 m) wide and less than 1 foot (0.3 m) deep, except in two known locations where beavers (*Castor canadensis*) have created additional dams and ponds. Another creek, draining the northwest corner of the site, joins this creek and flows from Mallard Pond approximately one-third of the way to the Savannah River (SNC 2007b).

Two stormwater retention ponds, referred to as Debris Basin #1 and #2, were created in the early stages of the construction of VEGP. The ponds were built south of the developed area of the site to retain sediment from stormwater. Debris Basin #1 drains south via a small creek to Beaverdam Creek south of the site boundary and halfway between an offsite pond (Telfair Pond) and the Savannah River. Debris Basin #2 drains via a small creek into Daniels Branch and then into Telfair Pond. Debris Basin #1 is about 6 ac (2.4 ha) in area, and Debris Basin #2 has an area of about 5 ac (2 ha). There is also a smaller runoff catch pond between these two ponds that was formed from a depression left after the construction of VEGP. The runoff pond is about 3 ac (1.2 ha) in size and retains water throughout the year (SNC 2007b).

The US Army Corps of Engineers issues guidance for jurisdictional delineations based on three wetland characteristics: hydrophilic vegetation, hydric soils, and overall hydrology. In December 2006, SNC surveyed the VEGP site and delineated 48 distinct, on-site wetlands totaling approximately 170 ac (69 ha). The majority of the wetlands on the VEGP site are along or near the Savannah River, with some wetlands occurring near the ponds and associated streams. On-site wetlands vary in surface water depth and vegetation canopy. Common trees occurring in the on-site wetlands are bald cypress, water oak, red maple, sweetgum, black willow (*Salix nigra*), and blackgum (*Nyssa sylvatica*). Vines and shrubs are commonly found in wetlands on-site and consist primarily of giant cane, trumpet creeper (*Campsis radicans*), muscadine, and American holly. Ground cover includes a herbaceous layer consisting primarily of cinnamon fern (*Osmunda cinnamomea*) and royal fern (*Osmunda regalis*) (TRC 2006, Eco-Sciences 2007).

The terrestrial fauna of the VEGP site consists mainly of wildlife species commonly found in eastern Georgia, including mammals, birds, reptiles, and amphibians. Mammals common to the VEGP site include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), small insectivores (moles, shrews, and bats) and rodents (mice and voles) (SNC 2007b).

The VEGP site has a variety of songbirds, upland game birds, waterfowl, and raptors that are located on and in the vicinity of the site. At least 143 species of birds were identified on the VEGP site during 2007. Common birds at the site include the northern bobwhite (*Colinus virginianus*), blue jay (*Cyanocitta cristata*), Carolina chickadee (*Poecile carolinensis*), mourning dove (*Zenaida macroura*), black vulture (*Coragyps atratus*), song sparrow (*Melospiza melodia*), dark-eyed junco (*Junco hyemalis*), northern cardinal (*Cardinalis cardinalis*), eastern bluebird (*Sialia sialis*), red-bellied woodpecker (*Melanerpes carolinus*), American woodcock (*Scolopax minor*), wood duck (*Aix sponsa*), and wild turkey (*Meleagris gallopavo*) (SNC 2006e, SNC 2007b).

Several bird species including the wood duck and bluebird have monitoring programs developed by the GPC for the VEGP site. Wood duck and bluebird boxes are located throughout the site and wood duck fledglings have been recorded annually (SNC 2007a).

Sixty species of reptiles and amphibians have been identified onsite, including the American alligator (*Alligator mississippiensis*), green anole (*Anolis carolinensis carolinensis*), bullfrog (*Rana catesbeiana*), snakes, turtles, lizards, salamanders, and toads (SNC 2006e).

2.2.6.2 Threatened and Endangered Terrestrial Species

Seven federally listed threatened or endangered species have been found to potentially occur in the vicinity of the VEGP site and associated transmission lines: the smooth coneflower (*Echinacea laevigata*), the Canby's dropwort (*Oxypolis canbyi*), the relict trillium (*Trillium reliquum*), the wood stork (*Mycteria americana*), the red-cockaded woodpecker (*Picoides borealis*), the flatwoods salamander (*Ambystoma cingulatum*), and the American alligator (*Alligator mississippiensis*). Five state listed threatened or endangered species have been found to potentially inhabit the VEGP site and associated transmission lines: the bay star-vine (*Schisandra glabra),* the pond spice (*Litsea aestivalis*), the gopher tortoises (*Gopherus polyphemus*), the spotted turtle (*Clemmys guttata*), and the hooded pitcher plants (*Sarracenia minor*) (TRC 2006; SNC 2007a). Table 2-10 shows the federally listed species known to potentially occur on the VEGP site, Table 2-11 shows the Federally listed species with occurrence in the counties that are crossed by transmission lines, Table 2-12 shows the rare terrestrial species that are State listed as either threatened or endangered and have potential to occur in the vicinity of the site, and Table 2-13 shows the rare terrestrial species that are State listed as either threatened or endangered and have the potential to occur in the vicinity of the associated transmission line ROWs.

Federally Protected Species

On July 9, 2007, the FWS issued a *Federal Register Notice* announcing the removal of the bald eagle (*Haliaeetus leucocephalus*) from the Federal List of Endangered and Threatened Wildlife (72 FR 37346). The bald eagle has been known to nest along the Savannah River. The eagle is a large bird, and can weigh more than 6 kg (13 lb.) as an adult. Juvenile eagles are completely brown and remain so until 5 to 6 years old, when they develop a white head. The species feed primarily on fish, as well as other small animals. There are no designated or proposed critical habitats for eagles on or in the vicinity of the VEGP site.

Table 2-10. Federally Listed Terrestrial Species with Recorded Occurrences or Potentially Occurring in the Vicinity of the VEGP Site [(a)]

Scientific Name	Common Name	Federal Status [(b)]	County of Occurrence	Distance from the VEGP Site [(c)]	Habitat [(d)]
Plants					
Echinacea laevigata	smooth coneflower	FE	Barnwell (SC), Aiken (SC)	< 10 mi (16 km)	Wooded upland areas on crystalline mineral soils
Oxypolis canbyi	Canby's dropwort	FE	Burke	>10 mi (16 km)	Cypress pond peat and muck, sinkhole depressions, and wet pine savannas
Trillium reliquum	relict trillium	FE	Aiken (SC)	>10 mi (16 km) [(e)]	Moist hardwood forests and forested sinkholes
Birds					
Mycteria Americana	wood stork	FE	Burke, Barnwell (SC), Aiken (SC)	<3.2 km (2 mi)	Marshes, river swamps, and cypress/gum ponds
Picoides borealis	red-cockaded woodpecker	FE	Burke, Barnwell (SC), Aiken (SC)	10 mi (16 km)	Open longleaf pine savannas and flatwoods with mixed understory

Table 2-10. (cont'd)

Scientific Name	Common Name	Federal Status [b]	County of Occurrence	Distance from the VEGP Site [c]	Habitat [d]
Amphibians and Reptiles					
Alligator mississippiensis [f]	American alligator	FT(S/A)	Burke, Barnwell (SC), Aiken (SC)	Occurs onsite [g]	Lakes, rivers, swamps, marshes, and ponds
Ambystoma cingulatum	flatwoods salamander	FT	Burke	>10 mi (16 km)	Isolated cypress/gum wetlands, wet pine flatwoods, moist savannas, and longleaf pine wetlands

(a) Species included in this table have suitable habitat on the VEGP site and satisfy at least one of the following criteria:
- species has been recorded on the VEGP site
- species has been recorded within 10 miles (16 km) of the VEGP site in Aiken or Barnwell Counties, South Carolina (SC) (SCDNR 2007, 2008)
- species is listed by FWS (2004) as occurring or having the potential to occur in Burke County, Georgia

(b) Federal status rankings determined by the FWS under the Endangered Species Act, FE = Endangered, FT = Threatened, FT(S/A) = Threatened (similarity of appearance) (FWS 2004, SCDNR 2007)
(c) NRC 2007
(d) GDNR 2008
(e) Suitable habitat exists for the relict trillium onsite (NRC 2007)
(f) The alligator is Federally listed for protection of the similar, endangered American crocodile. The alligator is not State-listed in Georgia or SC and is not tracked by county. Based on its range (Conant and Collins 1998), the alligator is expected to occur in all three counties.
(g) SNC 2007a

Table 2-11. Federally Listed Terrestrial Species Potentially Occurring in Counties Crossed by the Transmission Line ROWs [a]

Scientific Name	Common Name	Federal Status [b]	Counties of Occurrence [a]	Habitat [c]
Plants				
Echinacea laevigata	smooth coneflower	FE	Barnwell (SC)	Wooded upland areas on crystalline mineral soils
Lindera melissifolia	pond spicebush	FE	Chatham, Effingham, Screven	Wet savannas and on the margins of standing water bodies

Table 2-11. (cont'd)

Scientific Name	Common Name	Federal Status [b]	Counties of Occurrence [a]	Habitat [c]
Oxypolis canbyi	Canby's dropwort	FE	Burke, Screven, Barnwell (SC)	Cypress pond peat and muck, sinkhole depressions, and wet pine savannas
Trillium reliquum	relict trillium	FE	Jones	Moist hardwood forests and forested sinkholes
Birds				
Charadrius melodus	piping plover	FT	Bryan, Chatham, Glynn, Liberty, McIntosh	Sandy beaches and tidal flats
Dendroica kirtlandii	Kirtland's warbler	FE	Glynn	Species present on a temporary seasonal basis in spring and fall, multiple habitats
Mycteria americana	wood stork	FE	Bryan, Burke, Chatham, Effingham, Glynn, Jefferson, Liberty, Long, McIntosh, Richmond, Screven	Marshes, river swamps, and cypress/gum ponds
Picoides borealis	red-cockaded woodpecker	FE	Bryan, Burke, Chatham, Effingham, Glynn, Jefferson, Jones, Liberty, Long, McIntosh, Putnam, Richmond, Screven, Washington, Barnwell (SC)	Open longleaf pine savannas and flatwoods with mixed understory
Vermivora bachmanii	Bachman's warbler	FE	Bryan, Chatham, Glynn, Liberty, Long, McIntosh	Canebrake swamps, hardwood bottomlands, and wet hardwood forests

Table 2-11. (cont'd)

Scientific Name	Common Name	Federal Status [b]	Counties of Occurrence [a]	Habitat [c]
Amphibians and Reptiles				
Alligator mississippiensis [d]	American alligator	FT(S/A)	All	Lakes, rivers, swamps, marshes, and ponds
Ambystoma cingulatum	flatwoods salamander	FT	Bryan, Burke, Chatham, Effingham, Jefferson, Liberty, Long, McIntosh, Screven	Isolated cypress/gum wetlands, wet pine flatwoods, moist savannas, and longleaf pine wetlands
Drymarchon couperi	eastern indigo snake	FT	Bryan, Chatham, Glynn, Liberty, Long, McIntosh, Screven	Longleaf pine forests and pine flatwoods in the sandhills

(a) Counties crossed by ROWs include: Baldwin, Bryan, Burke, Chatham, Effingham, Glynn, Hancock, Jefferson, Jones, Liberty, Long, McIntosh, Monroe, Putnam, Richmond, Screven, and Washington in Georgia; and Barnwell in South Carolina. Federal occurrence data obtained from FWS (2004), GDNR (2008), and SCDNR (2007a).
(b) Federal listing status definitions: E = Endangered, T = Threatened, FT(S/A) = Threatened (similarity of appearance) FWS 2004)
(c) GDNR 2008
(d) The alligator is Federally listed for protection of the similar, endangered American crocodile. The alligator is not State listed in Georgia or SC and is not tracked by county. Based on its range (Conant and Collins 1998), the alligator is expected to occur in all 18 counties.

The smooth coneflower was listed by FWS as endangered in 1992 (57 FR 46340). There are 24 known populations of smooth coneflower in four southeastern states: three in Georgia (FWS 1995). The smooth coneflower prefers dry habitats such as open woods, roadsides, and limestone bluffs which have lots of sunlight and little competition from other herbaceous plant species, as wells as areas in post-burn succession stages (FWS 1995). Smooth coneflower prefers soils that have a neutral or basic pH and are rich in calcium and/or magnesium (NRC 2007). There is no known historical documentation of smooth coneflower on the VEGP site or in the associated transmission line ROWs, and suitable habitat for the species on the VEGP site is unlikely (NRC 2007; TRC 2006).

Canby's dropwort was listed as endangered by FWS in 1986 (51 FR 6690). Canby's dropwort is a perennial plant with quill-like leaves and small white or pink-tinged flowers and thick, corky wings extending from the margins of the plant's fruit (SCDNR undated). It occurs in a variety of wetland habitats, including cypress-dominated ponds. Canby's dropwort is generally found in areas with shallow and infrequent inundations [2 to 12 in. (5 to 30 cm)], and hydric soils (FWS 1990a). There have been no historical occurrences of Canby's dropwort recorded within 10 mi (16 km) of the site, and suitable habitat for the species on the VEGP site is unlikely (TRC 2006).

The relict trillium was listed as endangered by FWS in 1988 (53 FR 10879). This perennial species has three green leaves growing from the stem that is 2 to 10 in. (5 to 25 cm) long (USACE 2008). The purple to greenish yellow flower has no stalk and arises from the top of the stem (USACE updated). The species prefers moist hardwood forest habitats with sandy soils (FWS 1990b). There have been no known historical occurrences of relict trillium on the VEGP site or associated transmission lines, and suitable habitat for the species on the VEGP site is unlikely (SNC 2006f; TRC 2006).

The wood stork was listed as an endangered species in 1984 (49 CFR 7332). The species stands 2 to 4 ft (0.6 to 1.2 m) tall, weighs 7 to 10 lbs (3 to 4.5 kg), and can have a wingspan of 5 to 6 ft (1.5 to 1.8 m). The stork has a long, curved beak, no feathers on its neck, white feathers throughout the body and wings, and a black feathered tail. Since the species has no muscles attached to its vocal box, the bird is very quiet and croaks instead of sings. The wood stork is highly colonial and often remains in the same location for years. The wood stork generally selects groves of medium to tall trees that are either in standing water or are located on islands surrounded by open water. In Georgia, nesting sites are often in blackgum, willow (*Salix* spp.), and button bush. Colonies located in areas of standing water must remain inundated until the nesting period is complete to protect the young against predators and nest abandonment. In Georgia and South Carolina, wood storks lay eggs from March to late May, with fledging occurring in July and August (FWS 1997). The wood stork's diet consists almost entirely of fish (FWS 2007b).

The closest known stork colony is 28 mi (45 km) from the VEGP site. Individuals have been spotted within 2 mi (3.2 km) of the site (Wike et al. 2006). Additionally, there are two locations along the Scherer line ROW where wood stork have been sighted (TRC 2006). There are no known sightings of wood storks on the VEGP site (TRC 2006). However, it is potential foraging habitat for the species from June to September in wetlands along streams, man-made ponds, drainage ditches, and the cypress wetlands along the Savannah River near the VEGP site (NRC 2007).

Potential habitat for the endangered red-cockaded woodpecker is located within the VEGP site. The woodpecker prefers to nest in mature pine forests, especially longleaf pine. The bird's diet is composed mainly of insects, which include ants, beetles, wood-boring insects, caterpillars, and worms. The diet may also be supplemented with wild fruit. Red-cockaded woodpeckers use a cooperative breeding system, called a group. Groups typically consist of a breeding pair and potentially non-breeding helpers, which usually are males and non-breeders (FWS 2003a). Although there have been no known historical occurrences on the VEGP site (SNC 2006e, SNC 2007b, TRC 2006), SNC is in the process of enrolling the VEGP site in the GDNR Safe Harbor Program. Safe Harbor Agreements are arrangements that encourage voluntary management for red-cockaded woodpeckers while protecting the participating landowners and their rights for development in the event these woodpeckers become established on the private property.

The flatwoods salamander was listed by FWS as threatened in 1999 (64 FR 15691). The relatively small salamander is black or dark grey, with white, net-like streaks covering the top of the species from head to tail. The species prefers open woodlands dominated by longleaf or slash pine with herbaceous ground cover and wetland areas (72 FR 5856). The salamander breeds from October to December, and borrows during the remainder of the year. There have been no known historical occurrences of the species within 10 mi (16 km) of the VEGP site or associated transmission line ROWs, however, suitable habitat may exist (TRC 2006).

The American alligator is a large, semi-aquatic reptile that is similar in size and appearance and related to the Federally endangered American crocodile. Adults can grow to over 10 ft (3 m) in length. The alligator uses a variety of fresh and brackish water habitats, including marshes, ponds, lakes, rivers, swamps, and bayous. It digs dens below water where it retreats during cold weather or periods of drought. Eggs are laid in large mounded nests of leaves and other rotting vegetation, mud, rocks, and debris located in marshes or near the water's edge. The alligator feeds opportunistically on invertebrates, fish, amphibians, reptiles, birds, and mammals (NatureServe 2007). The American alligator occurs on the VEGP site in regularity. Its populations have recovered with legislative protection and are stable or increasing in most of its range. It is no longer endangered or threatened (NatureServe 2007). However, it has been listed by FWS since 1987 as threatened throughout its entire range due to its similarity in appearance to the endangered American crocodile, which is in greater need of protection (52 FR 21059).

State-Protected Species

One species, listed by the State of Georgia as threatened, the bay star-vine *(Schisandra glabra)*, was found on the VEGP site (TRC 2006). Bay star-vine grows on understory trees in rich forested areas, especially bottomlands and slopes. Older vines may grow on the trunks of overstory trees or may be rooted while growing along the ground, especially near thickets of mountain laurel *(Kalmia latifolia)*. The bay star-vine was found at several locations along the wooded bluff bordering the Savannah River and in a wooded wetland in the southern portion of the VEGP site (SNC 2007b; TRC 2006).

Four Georgia State-listed species were found to occur within the associated transmission line ROWs. All occurrences were on the West McIntosh (Thalmann) ROW. Pond spice (*Litsea aestivalis*), State listed as rare in Georgia, was found at one location near the Altamaha River in McIntosh County. Gopher tortoises (*Gopherus polyphemus*), State listed as threatened, were found at three locations, two areas near the Altamaha River in McIntosh County and one area in Effingham County. A spotted turtle (*Clemmys guttata*), State listed as unusual, was found at one location near Brier Creek in Screven County. Hooded pitcher plants (*Sarracenia minor*), State listed as unusual, were found at five locations in Chatham, Liberty, and McIntosh Counties (TRC 2006).

Table 2-12. State Listed Terrestrial Species with Recorded Occurrences in the Vicinity of the VEGP Site [a]

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	County of Occurrence [a]	Habitat [d]
Plants					
Agalinis linifolia	flaxleaf false foxglove		SC	Aiken (SC)	Wetlands [3]
Allium cuthbertii	striped garlic		SC	Barnwell (SC), Aiken (SC)	Sandy coastal plains and granite outcrop areas of the Piedmont [5]
Astragalus michauxii	sandhills milk-vetch		SC	Barnwell (SC)	Turkey-oak sandhill scrub and longleaf pine-wiregrass savannas [1]
Astragalus villosus	bearded milk-vetch		SC	Barnwell (SC)	Understory of scrub-oak sandhills and in dry open pinelands [4]
Baptisia lanceolata	lance-leaf wild-indigo		SC	Barnwell (SC)	Scrub oak barrens, coarse sand ridges, and turkey oak sandhills [4]
Carex cherokeensis	Cherokee sedge		SC	Barnwell (SC)	Riparian forests, bottomland hardwoods, wet seeps, swamp forests, and stream banks [5]
Carex decomposita	cypress-knee sedge		SC	Barnwell (SC)	On rafted wood debris and floating logs in swamps and along lake margins [1]
Carex socialis	social sedge		SC	Barnwell (SC)	Floodplain forests of rivers and streams [1]
Coreopsis rosea	rose coreopsis		RC	Barnwell (SC), Aiken (SC)	Damp depressions with sandy organic substrates [6]

Table 2-12. (cont'd)

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	County of Occurrence [a]	Habitat [d]
Croton elliotti	Elliott's croton		SC	Barnwell (SC), Aiken (SC)	Wet savannas, swamps, and pond margins [1]
Echinacea laevigata	smooth coneflower	SE	SE	Burke, Barnwell (SC), Aiken (SC)	Wooded upland areas on crystalline mineral soils [1]
Echinodorus parvulus	dwarf burhead		SC	Barnwell (SC), Aiken (SC)	Sinkhole ponds, depressions, and shallow inundated areas [1]
Elliottia racemosa	Georgia plume	ST		Burke	Forested scrub, open forests with shallow rock, and rock outcrops [1]
Epidendrum conopseum	greenfly orchid		SC	Barnwell (SC)	Typically growing on limbs of evergreen hardwoods, also in cracks and crevices of rock outcrops [1]
Gaura biennis	biennial gaura		SC	Barnwell (SC), Aiken (SC)	Dry open woods and prairies [7]
Ilex amelanchier	sarvis holly		SC	Barnwell (SC), Aiken (SC)	Cypress-gum swamps and densely vegetated wet sands [1]
Lindera subcoriacea	bog spicebush		RC	Barnwell (SC), Aiken (SC)	Forested seeps, wet slopes, and forested depressions [1]
Ludwigia spathulata	spatulate seedbox		SC	Barnwell (SC), Aiken (SC)	Wooded bogs, cypress-gum ponds, sinkhole ponds, and pools on granite outcrops [1]
Macbridea caroliniana	Carolina bird-in-a-nest		SC	Barnwell (SC)	Riparian woodlands, marshes, and swamps [1]
Monarda didyma	Oswego tea		SC	Barnwell (SC)	Moist open woods, riparian woodlands, and stream banks [3,6]
Nestronia umbellula	Indian olive	SR	SC	Burke, Barnwell (SC), Aiken (SC)	Along ecotones between flatwoods and uplands, in shrubby areas of mixed pine-hardwoods [1]
Nolina georgiana	Georgia beargrass		SC	Barnwell (SC), Aiken (SC)	Open sandy pine savannas and turkey-oak forests [5]
Paronychia americana	American nailwort		SC	Barnwell (SC)	Open areas and open pine-hardwoods and mixed forests [5]
Quercus sinuate	Durand's white oak		SC	Barnwell (SC)	Limestone slopes adjacent to streams and in bluff forests [1]

Table 2-12. (cont'd)

Scientific Name	Common Name	Georgia State Status (b)	South Carolina State Status (b)	County of Occurrence (a)	Habitat (d)
Rhododendron flammeum	Piedmont azalea		SC	Barnwell (SC), Aiken (SC)	Dry oak-hickory woodlands on well-drained rocky or sandy soils (2)
Rhynchospora inundata	drowned hornedrush		SC	Barnwell (SC), Aiken (SC)	Terraces within lower coastal plain wetlands (5)
Rorippa sessiliflora	stalkless yellowcress		SC	Barnwell (SC)	Inundated shallow depressions, wetlands, and marshes (7)
Sagittaria isoetiformis	slender arrowhead		SC	Barnwell (SC)	Shores of sandy-bottomed lakes in the Coastal Plain (5)
Sarracenia rubra	sweet pitcherplant	ST		Burke	Wet meadows and sphagnum moss cedar swamps (1)
Scutellaria ocmulgee	Ocmulgee skullcap	ST		Burke	Bluff forests and moist hardwood forests (1)
Trepocarpus aethusae	Aethusa-like trepocarpus		SC	Barnwell (SC)	Alluvial forests and woodlands (1)
Mammals					
Condylura cristata	star-nosed mole		SC	Barnwell (SC), Aiken (SC)	Wet soils in flood plains, swamps, meadows, and other openings near water (2)
Corynorhinus rafinesquii	Rafinesque's big-eared bat	SR	SE	Burke, Barnwell (SC), Aiken (SC)	Mixed forests, abandoned buildings, caves, and cavity snags (1)
Geomys pinetis	southeastern pocket gopher	ST		Burke	Long-leaf pine woods in deep, dry, loose sands with a rich herbaceous and grass understory (2)
Neotoma floridana	eastern woodrat		SC	Barnwell (SC), Aiken (SC)	Rock ledges and high-elevation forests (1)
Spilogale putorius	eastern spotted skunk		SC	Aiken (SC)	Rock outcrops in densely forested areas or habitats with significant cover and brushy areas (2)
Birds (c)					
Haliaeetus leucocephalus	bald eagle	ST	SE	Burke, Barnwell (SC)	Shorelines of large water bodies, marshes, and seacoasts (1)
Mycteria americana	wood stork	SE	SE	Burke, Barnwell (SC)	Marshes, river swamps, and cypress/gum ponds (1)

Table 2-12. (cont'd)

Scientific Name	Common Name	Georgia State Status [(b)]	South Carolina State Status [(b)]	County of Occurrence [(a)]	Habitat [(d)]
Picoides borealis	red-cockaded woodpecker	SE	SE	Burke, Barnwell (SC), Aiken (SC)	Open longleaf pine savannas and flatwoods with mixed understory [(1)]
Amphibians and Reptiles					
Ambystoma tigrinum tigrinum	eastern tiger salamander		SC	Barnwell (SC)	Upland pine forests, open fields, and isolated wetlands [(1)]
Heterodon simus	southern hognose snake	ST	SC	Burke, Barnwell (SC), Aiken (SC)	Fallow fields and longleaf pine-turkey oak forests in the Sandhills [(1)]
Hyla avivoca	bird-voiced treefrog		SC	Barnwell (SC), Aiken (SC)	Densely wooded swamps and floodplain forests [(2)]
Micrurus fulvius	eastern coral snake		SC	Barnwell (SC), Aiken (SC)	Under cover in pine-oak woodlands, pine flatwoods, and mixed hardwoods with sandy soils [(2)]
Pituophis melanoleucus	pine snake		SC	Barnwell (SC), Aiken (SC)	Dry pine forests or pine-hardwood forests [(1)]
T*Rana capito*	gopher frog	SR	SE	Burke, Barnwell (SC), Aiken (SC)	Isolated wetlands and adjacent areas in dry pine flatwoods on sandy soils [(1)]

(a) Occurrences considered in the vicinity are within approximately 10 miles of the VEGP site in Burke County, Georgia, or Barnwell or Aiken Counties, South Carolina (SC). State occurrence data and distances obtained from (GDNR 2007d, 2008) and (SCDNR 2007, 2008).

(b) State status determined by the GDNR and SCDNR: SE = State Endangered, ST = State Threatened, SR = State Rare, SU = State Unusual, RC = Of Concern Regionally, SC = Species of Concern (GDNR 2007d; SCDNR 2007)

(c) The bald eagle, wood stork, and red-cockaded woodpecker are listed as occurring in Burke County (FWS 2004). However, there are no records of these species in Burke Country within 10 miles of the VEGP site.

(d) Habitat information sources:
[1] GDNR 2008
[2] NatureServe 2007
[3] NRCS 2008
[4] USF 2008
[5] FNA Editorial Committee 1993+
[6] Lady Bird Johnson Wildflower Center NPIN 2008
[7] Robert W. Freckmann Herbarium 2008

Table 2-13. State Listed Terrestrial Species with Recorded Occurrences in the Counties Crossed by the Transmission Line ROWs [(a)]

Scientific Name	Common Name	Georgia State Status [(b)]	South Carolina State Status [(b)]	Counties of Occurrence [(a)]	Habitat [(c)]
Plants					
Allium cuthbertii	striped garlic		SC	Barnwell (SC)	Sandy coastal plains and granite outcrop areas of the Piedmont [(5)]
Amphicarpum muehlenbergianum	blue maiden cane		SC	Barnwell (SC)	Open areas within wet flatwoods on the outer margins of herb-dominated marshes [(4)]
Astragalus michauxii	sandhill milk-vetch	ST	SC	Richmond, Screven, Washington, Barnwell (SC)	Turkey-oak sandhill scrub and longleaf pine-wiregrass savannas [(1)]
Astragalus villosus	bearded milk-vetch		SC	Barnwell (SC)	Understory of scrub-oak sandhills and in dry open pinelands [(4)]
Balduina atropurpurea	purple honeycomb head	SR		Liberty, Long	Pocosins, pitcherplant bogs, and wet savannas [(1)]
Baptisia lanceolata	lance-leaf wild indigo		SC	Barnwell (SC)	Scrub oak barrens, coarse sand ridge, and turkey oak sandhills [(4)]
Carex dasycarpa	velvet sedge	SR		Liberty, Long, McIntosh	Moist hardwood forests and evergreen hammocks [(1)]
Carex decomposita	cypress-knee sedge		SC	Barnwell (SC)	On rafted wood debris and floating logs in swamps and along lake margins [(1)]
Carya myristiciformis	nutmeg hickory		RC	Barnwell (SC)	Flatwoods with calcareous soils [(1)]
Ceratiola ericoides	sandhill rosemary	ST		Burke	Sandy, well-drained, acidic soils in dry open pinelands, scrub oak woods,and scrubby flatwoods [(6,10)]
Chamaecyparis thyoides	Atlantic white cedar	SR		Richmond	Within the sandhills region in clearwater streams and swamps [(1)]
Coreopsis integrifolia	floodplain tickseed	ST		Glynn	Along streambanks and in riparian areas and alluvial forests [(1)]

1 **Table 2-13.** (cont'd)

2

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	Counties of Occurrence [a]	Habitat [c]
Croton elliotti	Elliot's croton		SC	Barnwell (SC)	Wet savannas, swamps, and pond margins [1]
Cuscuta harperi	Harper's dodder	SE		Washington	Herbaceous communities on rock outcrops, often with dwarf blazing star as a host species [1]
Cypripedium acaule	pink ladyslipper	SU		Richmond	Upland pine forests and mixed oak-hickory-pine forests [1]
Dicerandra radfordiana	Radford's mint	SE		McIntosh	Sand ridges [1]
Echinacea laevigata	smooth coneflower		SE	Barnwell (SC)	Wooded upland areas on crystalline mineral soils [1]
Echinodorus parvulus	dwarf burhead		SC	Barnwell (SC)	Sinkhole ponds, depressions, and shallow inundated areas [1]
Elliottia racemosa	Georgia plume	ST		Bryan, Burke, Long	Forested scrub, open forests with shallow rock, and rock outcrops [1]
Epidendum conopseum	greenfly orchid	SU		Bryan, Effingham, Glynn, Liberty, Long, McIntosh	Typically growing on limbs of evergreen hardwoods, also in cracks and crevices of rock outcrops [1]
Eriocaulon koernickianum	dwarf hatpins	SE		Hancock	Rock outcrops [1]
Forestiera segregata	Florida wild privet	SR		Chatham, Glynn, McIntosh	Coastal scrub forest shell mounds and barrier islands [1]
Fothergilla gardenia	dwarf witch alder	ST		Long	Swamps and open wooded areas in topographic depressions [1]
Gaura biennis	biennial gaura		SC	Barnwell (SC)	Dry open woods and prairies [7]
Halesia parviflora	small-flowered silverbell tree		SC	Barnwell (SC)	Moist acidic organic soils, typically in partial shade [9]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	Counties of Occurrence [a]	Habitat [c]
Helenium brevifolium	shortleaf sneezeweed		RC	Barnwell (SC)	Pitcher plant bogs and seepage depressions [1]
Helenium pinnatifidum	southeastern sneezeweed		SC	Barnwell (SC)	Wetlands and open swamps [4]
Hypericum adpressum	creeping St. John's wort		RC	Barnwell (SC)	Swamps and sparsely wooded wetlands [1]
Ipomopsis rubra	standing cypress		SC	Barnwell (SC)	Dry soils with sand, gravel, or rocky composition [6]
Leitneria floridana	corkwood	ST		Glynn, McIntosh	Saw palmetto marshes, pocosins, and cabbage palm wetlands [1]
Lindera melissifolia	pond spicebush	SE		Chatham, Effingham, Screven	Wet savannas and on the margins of standing water bodies [1]
Lindera subcoriacea	bog spicebush		RC	Barnwell (SC)	Forested seeps, wet slopes, and forested depressions [1]
Litsea aestivalis	pond spice	SR		Bryan, Effingham, Glynn, Long, McIntosh	Swamp margins, pocosins, and cypress ponds [1]
Lobelia boykinii	Boykin's lobelia		SC	Barnwell (SC)	Cypress pond peat and muck, sinkhole depressions, and wet pine savannas, often with Canby's dropwort [1]
Ludwigia spathulata	spatulate seedbox		SC	Barnwell (SC)	Wooded bogs, cypress-gum ponds, sinkhole ponds, and pools on granite outcrops [1]
Macbridea caroliniana	Carolina bird-in-a-nest		SC	Barnwell (SC)	Riparian woodlands, marshes, and swamps [1]
Marshallia ramose	pineland Barbara buttons	SR		Washington	Open forests overlying shallow rock and rock outcrops [1]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	Counties of Occurrence [a]	Habitat [c]
Matelea pubiflora	trailing milkvine	SR		Long, McIntosh	Sandridge areas and on exposed sandy soils [1]
Menispermum canadense	Canada moonseed		SC	Barnwell (SC)	Alluvial hardwood forests and bluff forests [5]
Monarda didyma	Oswego tea		SC	Barnwell (SC)	Moist open woods, riparian woodlands, and stream banks [3,6]
Nolina georgiana	Georgia beargrass		SC	Barnwell (SC)	Open sandy pine savannas and turkey-oak forests [5]
Oxypolis canbyi	Canby's dropwort	SE	SE	Burke, Screven, Barnwell (SC)	Cypress pond peat and muck, sinkhole depressions, and wet pine savannas, often found with Boykin's lobelia [1]
Paronychia americana	American nailwort		SC	Barnwell (SC)	Open areas and open mixed pine-hardwoods [5]
Penstemon dissectus	cutleaf beardtongue	SR		Jefferson, Long	Rock outcrops and pine savannas near shallow rock outcrops [1]
Platanthera lacera	green-fringed orchid		SC	Barnwell (SC)	Wet depressions, bogs, riparian meadows, hydric sand flats, alluvial forests, swamps, stream banks, and wet prairies [5]
Pteroglossaspis ecristata	crestless plume orchid	ST		Liberty, Long, McIntosh	Longleaf pine savannas, pine grasslands, and grassy saw palmetto barrens [1]
Quercus sinuate	Durand's white oak		SC	Barnwell (SC)	Limestone slopes adjacent to streams and in bluff forests [1]
Rhexia aristosa	awned meadowbea uty		SC	Barnwell (SC)	Grass-sedge dominated Carolina bays, wet savannas, depression meadows, sinkhole ponds, and cypress bays [8]
Rhododendron flammeum	Piedmont azalea		SC	Barnwell (SC)	Dry oak-hickory woodlands on well-drained rocky or sandy soils [2]
Rhynchospora inundata	drowned hornedrush		SC	Barnwell (SC)	Terraces within lower coastal plain wetlands [5]

1 **Table 2-13.** (cont'd)

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	Counties of Occurrence [a]	Habitat [c]
Rhynchospora tracyi	Tracy's beakrush		SC	Barnwell (SC)	Emergent in freshwater marshes, ditches and swales, or in cypress dome shallows [5]
Sageretia minutiflora	climbing buckthorn	ST		Bryan, Glynn, McIntosh	Maritime forests over shell mounds and calcareous bluff forests [1]
Sagittaria isoetiformis	slender arrowhead		SC	Barnwell (SC)	Shores of sandy-bottomed lakes in the Coastal Plain [5]
Sarracenia flava	yellow flytrap	SU		Effingham, Long	Wet savannas and pitcher plant bogs [1]
Sarracenia minor	hooded pitcherplant	SU		Bryan, Burke, Chatham, Glynn, Liberty, Long, McIntosh, Screven	Wet savannas and pitcher plant bogs [1]
Sarracenia rubra	sweet pitcherplant	ST		Burke, Jefferson, Richmond	Wet meadows and sphagnum moss cedar swamps [1]
Schisandra glabra	bay star vine	ST		Washington	Stream terraces and lower slopes within rich woodlands [1]
Scleria reticularis	reticulated nutrush		SC	Barnwell (SC)	Wet savannas and swales, and pond and lake margins [5]
Scutellaria ocmulgee	Ocmulgee skullcap	ST		Burke, Richmond	Bluff forests and moist hardwood forests [1]
Sideroxylon macrocarpum	Ohoopee bumelia	SR		Long	Dry pine flatwoods and savanna with oak understory, often hidden in wiregrass [1]
Sideroxylon thornei	swamp buckthorn	SR		Liberty	Calcareous swamps and forested sinkhole depressions [1]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [(b)]	South Carolina State Status [(b)]	Counties of Occurrence [(a)]	Habitat [(c)]
Stewartia malacodendron	silky camellia	SR		Bryan, Burke, Effingham, Hancock, Liberty, Richmond, Screven, Washington	Beech hardwood forests along streams and on lower slopes [(1)]
Stillingia aquatica	corkwood		SC	Barnwell (SC)	Old-growth pond cypress depressions [(4)]
Stylisma pickeringii var. pickeringii	Pickering's morning glory	ST		Richmond	Sandhill oak scrub [(1)]
Symphyotrichum georgianum	Georgia aster	ST		Richmond	Open areas of mixed upland forests with mineral soils, sometimes with smooth purple coneflower [(1)]
Trautvetteria caroliniensis	Carolina tassel rue		SC	Barnwell (SC)	Wet meadows, stream banks, bogs, and wooded seepage slopes [(5)]
Trillium reliquum	relict trillium	SE		Jones	Moist hardwood forests and forested sinkholes [(1)]
Birds					
Aimophila aestivalis	Bachman's sparrow	SR		Bryan, Liberty, Long, McIntosh	Open woods, brushy areas, and old fields [(1)]
Ammodramus henslowii	Henslow's sparrow	SR		Glynn	Wet grasslands [(1)]
Charadrius melodus	piping plover	ST		Chatham, Glynn, Liberty, McIntosh	Sandy beaches and tidal flats [(1)]
Charadrius wilsonia	Wilson's plover	ST		Chatham, Glynn, Liberty, McIntosh	Sandy beaches and tidal flats [(1)]
Egretta caerulea	little blue heron		SC	Barnwell (SC)	Marshes, lakes, and ponds [(1)]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [(b)]	South Carolina State Status [(b)]	Counties of Occurrence [(a)]	Habitat [(c)]
Elanoides forficatus	swallow-tailed kite	SR		Bryan, Effingham, Glynn, Long, McIntosh, Screven	Marshes and floodplain swamps [(1)]
Falco sparverius paulus	southeastern American kestrel	SR		Long	Open pine grasslands with snags [(1)]
Haematopus palliates	American oystercatcher	SR		Chatham, Glynn, McIntosh	Salt marshes, tidal flats, and sandy beaches [(1)]
Haliaeetus leucocephalus	bald eagle	ST	ST	Baldwin, Bryan, Chatham, Glynn, Hancock, Jefferson, Jones, Liberty, Long, McIntosh, Monroe, Barnwell (SC)	Shorelines of large water bodies, marshes, and seacoasts [(1)]
Picoides borealis	red-cockaded woodpecker	SE	SE	Bryan, Chatham, Effingham, Jones, Liberty, Long, Putnam, Washington, Barnwell (SC)	Open longleaf pine savannas and flatwoods with mixed understory [(1)]
Rynchops niger	black skimmer	SR		Chatham, Glynn, McIntosh	Tidal ponds and sandy beaches [(1)]
Sterna antillarum	least tern	SR		Chatham, McIntosh	Sandy beaches and sandbars [(1)]
Sterna nilotica	gull-billed tern	ST		Glynn, McIntosh	Salt marshes and sandy beaches [(1)]
Vermivora bachmanii	Bachman's warbler	SE		Long	Canebrake swamps and bottomland hardwoods [(1)]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [(b)]	South Carolina State Status [(b)]	Counties of Occurrence [(a)]	Habitat [(c)]
Amphibians and Reptiles					
Ambystoma cingulatum	flatwoods salamander	ST		Bryan, Burke, Chatham, Liberty, Long, McIntosh, Screven	Isolated cypress/gum wetlands, wet pine flatwoods, moist savannas, and longleaf pine wetlands [(1)]
Clemmys guttata	spotted turtle	SU	ST	Bryan, Burke, Chatham, Effingham, Jefferson, Liberty, Long, McIntosh, Screven, Washington, Barnwell (SC)	Small ponds, marshes, bogs, and heavily vegetated swamps [(1)]
Drymarchon couperi	eastern indigo snake	ST		Bryan, Glynn, Long, McIntosh	Longleaf pine forests and pine flatwoods in the sandhills [(1)]
Gopherus polyphemus	gopher tortoise	ST		Bryan, Chatham, Effingham, Glynn, Liberty, Long, McIntosh, Screven, Washington	Longleaf pine-turkey oak woods and pine flatwoods in sandy soils with rich herbaceous communities [(1)]
Heterodon simus	southern hognose snake	ST		Bryan, Burke, Effingham, Jefferson, Liberty, Long, Richmond, Screven	Fallow fields and longleaf pine-turkey oak forests in the Sandhills [(1)]
Hyla avivoca	bird-voiced treefrog		SC	Barnwell (SC)	Densely wooded swamps and floodplain forests [(2)]
Notophthalmus perstriatus	striped newt	ST		Bryan, Liberty, Long, Screven	Isolated wetlands in pine savannas and flatwoods [(1)]
Ophisaurus mimicus	mimic glass lizard	SR		Effingham, Liberty, Long, McIntosh	Seepage bogs, wet pine savannas, and wet flatwoods [(1)]

Table 2-13. (cont'd)

Scientific Name	Common Name	Georgia State Status [b]	South Carolina State Status [b]	Counties of Occurrence [a]	Habitat [c]
Rana capito	gopher frog	SR	SE	Bryan, Burke, Chatham, Liberty, Long, McIntosh, Richmond, Screven, Barnwell (SC)	Isolated wetlands and adjacent areas in dry pine flatwoods on sandy soils [1]
Insects					
Cordulegaster sayi	Say's spiketail	ST		Effingham, Liberty	Silty-mucky seepage areas and pools of first-order, spring-fed streams [1]
Mammals					
Condylura cristata	star-nosed mole		SC	Barnwell (SC)	Wet soils in flood plains, swamps, meadows, and other openings near water [2]
Corynorhinus rafinesquii	Rafinesque's big-eared bat	SR	SE	Liberty, McIntosh, Barnwell (SC)	Mixed forests, abandoned buildings, caves, and cavity snags [1]
Neotoma floridana	eastern woodrat		SC	Barnwell (SC)	Rock ledges and high-elevation forests [1]

(a) Counties crossed by ROWs include: Baldwin, Bryan, Burke, Chatham, Effingham, Glynn, Hancock, Jefferson, Jones, Liberty, Long, McIntosh, Monroe, Putnam, Richmond, Screven, and Washington in Georgia; and Barnwell in South Carolina. State occurrence data and distances obtained from GDNR (2008) and SCDNR (2007a).

(b) State status determined by the GDNR and SCDNR: SE = State Endangered, ST = State Threatened, SR = State Rare, SU = State Unusual, SC = Species of Concern (GDNR 2008; SCDNR 2007).

(c) Habitat information sources:
[1] GDNR 2008
[2] NatureServe 2007
[3] NRCS 2008
[4] USF 2008
[5] FNA Editorial Committee 1993+
[6] Lady Bird Johnson Wildflower Center NPIN 2008
[7] Robert W. Freckmann Herbarium 2008
[8] The Center for Plant Conservation 2008
[9] Kemper Center for Home Gardening 2008
[10] USDA 2008

2.2.7 Radiological Impacts

Radiological releases, doses to members of the public, and the resultant environmental impacts, are summarized in two VEGP reports: the *Annual Radioactive Effluent Release Report* (SNC 2003a, 2004a, 2005a, 2006b, 2007c) *and the Annual Radiological Environmental Operating Report* (SNC 2003b, 2004b, 2005c, 2006g, 2007m). Limits for all radiological releases are specified in the VEGP ODCM and are used to meet Federal radiation protection limits and standards. The following discussion focuses on 1) the radiological environmental impacts and 2) the dose impacts to the public and the environment, in and around the VEPG site.

1) Radiological Environmental Impacts:

VEGP conducts a radiological environmental monitoring program (REMP) in which radiological impacts to the environment and the public around the VEGP site are monitored, documented, and compared to NRC standards. VEPG summarizes the results of their REMP in an *Annual Radiological Environmental Operating Report* (SNC 2003b, 2004b, 2005c, 2006g, 2007m). The pre-operational stage of the VEPG's REMP began with initial sample collections in August of 1981. The transition from pre-operational to operational stage of VEPG's REMP occurred as Unit 1 reached initial criticality on March 9, 1987. The objectives of the VEPG's REMP are to:

- Measure and evaluate the effects of facility operation on the environs and verify the effectiveness of the controls on radioactive effluents;
- Monitor natural radiation levels in the environs of the VEGP site; and
- Demonstrate compliance with the requirements of applicable Federal regulatory agencies, including technical specifications and the ODCM.

The REMP at VEPG samples environmental media in the environs around the site to analyze and measure the radioactivity levels that may be present. The media samples are representative of the radiation exposure pathways to the public from all plant radioactive effluents. The REMP measures direct radiation, the airborne, and the waterborne pathways for radioactivity in the vicinity of the VEPG site. Direct radiation pathways include radiation from buildings and plant structures and airborne material that may be released from the plant. In addition, the REMP also measures background radiation (i.e., cosmic sources, naturally occurring radioactive material, including radon and global fallout). Thermoluminescent dosimeters (TLDs) are used to measure direct radiation. The airborne pathway includes measurements of radioiodine and particulates in air samples. The waterborne pathway consists of measurements of surface water, drinking water, and sediment from the Savannah River.

During 2006, there were no plant-related activation or fission products detected in airborne samples, milk, and grassy or broadleaf vegetation. Radionuclides attributable to plant operation were detected during 2006 in samples of surface water, fish, drinking water, and shoreline sediment (SNC 2007m). However, the reported data on the radionuclides detected in environmental samples were below applicable NRC reporting levels and showed no significant or measurable impact on the environment from the operation of VEGP.

The Georgia Environmental Protection Division (GEPD) has an extensive environmental radiation monitoring program that routinely conducts sampling and analysis of selected environmental media in conjunction with VEGP. The GEPD's environmental radiation monitoring program includes TLDs for monitoring direct radiation, samples of air, precipitation, soil, vegetation, milk, assorted crops, surface (river) water, groundwater, fish, seafood, and river sediment. The results of the GEPD's 2000 to 2002 environmental radiation monitoring report showed that the levels of radionuclides detected in environmental samples were below applicable NRC reporting levels and showed no significant or measurable impact on the environment from the operation of VEPG (GEPD 2004).

In addition to the routine REMP, the applicant established an on-site groundwater protection program in 2006. The program is designed to monitor the on-site environment for indication of leaks from plant systems and pipes carrying liquids with radioactive material. The results were reported in the VEGP *2006 Annual Radiological Environmental Operating Report* (SNC 2007m). The report stated that, in 2006, VEGP sampled onsite drinking water deep wells and onsite makeup water deep wells for tritium and gamma isotopic activity. No detectable activity was found in the water samples. The applicant plans to implement a more extensive radiological groundwater monitoring program that may include additional monitoring wells based on site hydrology information. The results of the monitoring program will be reported each year in the *Annual Radiological Environmental Operating Report*.

2) Radiological Dose Impacts:

A review of historical data on radiological releases from VEGP during the period from 2002 through 2006 and the resultant dose calculations demonstrate that the dose to a maximally exposed individual in the vicinity of VEGP was a small fraction of the limits and standards specified in 10 CFR Part 20, Appendix I to 10 CFR Part 50, and 40 CFR Part 190. VEPG summarizes the results of their radiological releases and the resultant doses in the *Annual Radioactive Effluent Release Report* (SNC 2003a, 2004a, 2005a, 2006b, 2007c). A summary of the calculated maximum dose to an individual located at the VEGP site boundary from liquid and gaseous effluents released during 2006 is as follows:

For 2006, dose values for each reactor unit were calculated based on actual liquid and gaseous effluent release data and conservative models to simulate the transport mechanisms. The results are described in the *2006 Annual Radioactive Effluent Release Report* (SNC 2007c).

The 2006 calculated maximum whole-body dose to an offsite member of the general public from liquid effluents was 3.01 E-02 millirem (mrem) (3.01 E-04 millisievert [mSv]) for Unit 1 and 2.20 E-02 mrem (2.20 E-04 mSv) for Unit 2. These doses are well below the 3 mrem (0.03 mSv) per reactor dose design objective in Appendix I to 10 CFR Part 50.

The 2006 calculated maximum organ dose to an offsite member of the general public from liquid effluents was 3.40 E-02 mrem (3.40 E-04 mSv) to the liver for Unit 1 and 2.36 E-02 mrem (2.36 E-04 mSv) to the lung for Unit 2, These doses are well below the 10 mrem (0.10 mSv) dose design objective in Appendix I to 10 CFR Part 50.

The 2006 calculated maximum gamma air dose at the site boundary from noble gas discharges was 3.14 E-05 millirad (mrad) (3.14 E-07 milligray [mGy]) for Unit 1 and 6.89 E-05 mrad (6.89 E-07 mGy) for Unit 2. These doses are well below the 10 mrad (0.10 mGy) dose design objective in Appendix I to 10 CFR Part 50.

The 2006 calculated maximum beta air dose at the site boundary from noble gas discharges was 1.79 E-05 mrad (1.79 E-07 mGy) for Unit 1 and 6.14 E-05 mrad (6.14 E-06 mGy) for Unit 2. These doses are well below the 20 mrad (0.20 mGy) dose design objective in Appendix I to 10 CFR Part 50.

The 2006 calculated maximum organ dose to an offsite member of the general public from gaseous radioiodine, tritium, and particulate effluents was 3.85 E-04 mrem (3.85 E-06 mSv) for Unit 1 and 1.40 E-04 mrem (1.40 E-06 mSv) for Unit 2. These doses are well below the 15 mrem (0.15 mSv) dose design objective in Appendix I to 10 CFR Part 50.

The NRC staff found that the 2006 radiological data are consistent, with reasonable variation due to operating conditions and outages, with the five year historical radiological effluent releases and resultant doses. These results confirm that VEPG is operating in compliance with Federal radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190.

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposure pathways from VEGP operations during the license renewal term and the impacts to the environment are, therefore, not expected to change. Based on the applicant's assertion that there are no refurbishment activities planned, similar small doses to members of the public and small impacts to the environment are expected over the license renewal term.

2.2.8 Socioeconomic Factors

This section describes current socioeconomic factors that have the potential to be directly or indirectly affected by changes in operations at VEGP. VEGP and the communities that support it can be described as a dynamic socioeconomic system. The communities provide the people, goods, and services required by VEGP operations. VEGP operations, in turn, create the demand and pay for the people, goods, and services in the form of wages, salaries, and benefits for jobs and dollar expenditures for goods and services. The measure of the communities' ability to support the demands of VEGP depends on their ability to respond to changing environmental, social, economic, and demographic conditions.

The socioeconomics region of influence (ROI) is defined by the areas where VEGP employees and their families reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. The ROI consists of a three-county area, which is where approximately 80 percent of VEGP employees reside: Columbia (34 percent), Richmond (26 percent), and Burke (20 percent). The following sections describe the housing, public services, off-site land use, visual aesthetics and noise, population demography, and the economy in the ROI surrounding the VEGP site.

VEGP employs a permanent workforce of around 860 employees (SNC 2007a). Approximately 90 percent live in Burke, Columbia, Richmond, and Screven Counties, Georgia and Aiken County, South Carolina (Table 2-14). The remaining 10 percent are divided among 15 counties in Georgia and 6 counties in South Carolina with numbers ranging from 1 to 16 employees per county. Given the location of VEGP and the residential locations of VEGP employees, the most significant impacts of plant operations are likely to occur in Burke, Columbia, and Richmond counties, Georgia, where approximately 80 percent of the VEGP employees reside. The focus of the analysis in this draft SEIS is therefore on the impacts of VEGP in these three counties.

VEGP schedules refueling outages at 18-month intervals. During refueling outages, site employment increases by as many as 800 workers for approximately 30 days of temporary duty. Most of these workers are assumed to be located in the same geographic areas as the permanent VEGP staff.

Table 2-14. VEGP Permanent Employee Residence by County in 2005

County [(a)]	Workforce Number	Percent of Workforce	County Population [(b)]
Columbia	289	34	103,490
Richmond	224	26	194,135
Burke	170	20	23,154
Screven	58	7	15,288
Aiken	37	4	150,053
Jenkins	16	2	8,715

Table 2-14. (cont'd)

County [(a)]	Workforce Number	Percent of Workforce	County Population [(b)]
Jefferson	13	2	16,783
Emanuel	12	1	22,186
Bulloch	10	1	62,011
Other Counties	33	3	--
Total	**862**	**100**	**--**

(a) Listed counties are located in Georgia except for Aiken, which is in South Carolina.
(b) Estimated 2005 population.
Source: SNC 2007a and USCB 2007a

2.2.8.1 Housing

Table 2–15 lists the total number of occupied housing units, vacancy rates, and median value in the three-county ROI. According to the 2000 Census, there were nearly 124,500 housing units in the ROI, of which approximately 113,000 were occupied; the median value of owner-occupied units was $84,900. The vacancy rate was higher in Burke and Richmond Counties (10 percent) and lower in Columbia County (7 percent). The median value was highest in Columbia County ($118,000).

In 2005, the total number of housing units in Burke County had grown by more than 330 units to 9178 (USCB 2007b).

Table 2-15. Housing in Burke, Columbia, and Richmond Counties, Georgia, in 2000

	Burke	Columbia	Richmond	ROI
Total housing units	8,842	33,321	82,312	124,475
Occupied housing units	7,934	31,120	73,920	112,974
Vacant units	908	2,201	8,392	11,501
Vacancy rate (percent)	10	7	10	9
Median value (dollars)	59,800	118,000	76,800	84,900

Source: USCB 2000a

2.2.8.2 Public Services

2.2.8.2.1 Water Supply

Approximately 80 percent of the VEGP employees reside in Columbia (34 percent), Richmond (26 percent), and Burke (20 percent) Counties (SNC 2007a). The major public water suppliers in the three counties, including municipalities, obtain their drinking water supply from surface water and/or groundwater sources. Columbia County lies north of the Fall Line, a geomorphic boundary between the Piedmont and the Coastal Plain. It is characterized by a limited groundwater supply because of the dense, crystalline rock underlying the area. Like most of the large municipal systems above the Fall Line, Columbia County obtains its water from the Savannah River or one of its impoundments (USCB 2000a).

In the Coastal Plains of Georgia and South Carolina, two major regional aquifer systems can supply about 3 mgd of water: the Cretaceous and the Tertiary. Most counties in the Coastal Plain, including Burke and Richmond, obtain their water from these aquifers; some municipalities use the Savannah River to supplement their supply (CSRARDC 2005). Tables 2-16 and 2-17 provide public water supply information for the Burke, Columbia, and Richmond County community water systems, including permitted capacity and average daily production. Table 2-16 presents information for groundwater withdrawals and Table 2-17 addresses surface water withdrawals. The population served by each system, by water source, is also provided.

Table 2-16. Public Water Supply System Capacity and Usage for Groundwater Withdrawals

System Name	Permitted Annual Average Withdrawal (MGD)	Reported Annual Average Withdrawal (MGD)	Population Served
Burke County			
Waynesboro	3.50	0.79	5,813
Sardis	0.40	0.07	1,152
Columbia County			
Columbia County[(a)]	0.58	0.00	77,280
Grovetown	0.90	0.13	6,089
Harlem	0.25	0.02	4,290
Richmond County			
Augusta-Richmond County Water System	17.40	8.40	180,000

Table 2-16. (cont'd)

System Name	Permitted Annual Average Withdrawal (MGD)	Reported Annual Average Withdrawal (MGD)	Population Served
Hephzibah	1.20	0.34	3,011

(a) Columbia County system is withdrawn primarily from surface-water systems

Sources: GEPD 2005 (permitted withdrawal), SNC 2007a (reported withdrawal), and EPA 2007 (population).

Table 2-17. Public Water Supply System Capacity and Usage for Surface Water Withdrawals

System Name	Permitted Monthly Average Withdrawal (MGD)	Reported Monthly Average Withdrawal (MGD)	Population Served
Burke County			
Waynesboro	1.0	0.10 - 0.19	5,813
Sardis[(a)]	--	--	--
Columbia County			
Columbia County	39.0	8.35 - 17.78	77,280
Grovetown[(a)]	--	--	--
Harlem[(a)]	--	--	--
Richmond County			
Augusta-Richmond County Water System	60.0	24.40 - 44.34	180,000
Hephzibah[(a)]	--	--	--

(a) System does not withdraw surface water.

Sources: GEPD 2007(permitted withdrawal), SNC 2007a (reported withdrawal), and EPA 2007 (population).

According to the regional planning agency for the central Savannah River area, Burke, Columbia, and Richmond Counties are adequately served by the existing water supply and it is estimated that the region will have sufficient supply through the planning period (that is, 2005 to 2025) (CSRARDC 2005).

2.2.8.2.2 Education

Burke, Columbia, and Richmond Counties have a total of 96 public primary and secondary schools, with a 2006 to 2007 student enrollment of 58,544 (GOSA 2007). The public school systems in the three-county ROI surrounding the VEGP site are organized by county. The largest of these school districts is Richmond County School District, which has a student enrollment of more than 32,000. Although it has had over-crowding issues for several years, the district now meets the student-teacher ratios mandated by the Georgia Department of Education. The Columbia County School District, with a student enrollment of over 20,000, is the second largest of the three districts. It has had the highest rate of growth of the three districts in recent years. Enrollment grew by more than 1000 students during the 2005 to 2006 school year and an increase of approximately 800 is expected for the 2007 to 2008 year. The district provides educational services to high growth residential areas near the city of Augusta and struggles to meet State-mandated student-teacher ratios. The Columbia County Board of Education has given high priority to new school construction. Burke County School District, the smallest of the three, differs from the two larger districts in that it has excess capacity. The Burke County School District office estimates that it has excess capacity of approximately 17 percent as of the 2006 to 2007 school year, and that their schools could serve 700 to 800 additional students (NRC 2007).

2.2.8.2.3 Transportation

Figures 2-1 and 2-2 show the VEGP site and highways within a 50-mi radius and a 6-mi radius of VEGP. At the larger regional scale, the major highways serving VEGP are:

(1) Interstate 20 (I-20), located approximately 25 miles north of VEGP, which runs east-west through Augusta and connects Columbia, South Carolina, and Atlanta, Georgia;
(2) I-520, which is a beltway that partly encircles Augusta to the west and south;

(3) U.S. Route 25, a major north-south highway which is located approximately 15 miles west of VEGP and runs through the city of Waynesboro;

(4) The Savannah River Parkway, a new four-lane connector under construction between Augusta and Savannah, which follows U.S. Route 25 in its route through the county (Burke County portion is open to traffic (Burke County 2007); and

(4) State Route 56, which connects rural towns in Burke County with Augusta to the north, and State Route 23, located approximately 4 miles west of VEGP, which connects with State Route 56 north of VEGP.

Local road access to VEGP is via County Road 59, also known as River Road, which forks off from State Route 56 north of the site and intersects with the VEGP access road. Employees who live to the north of VEGP in Columbia and Richmond Counties travel south on State Route 56 and then take River Road to reach the site. Employees living to the west in Richmond County would either connect directly to State Route 56 or use U.S. Route 25 and then take a county road to connect to State Route 56 and from there to River Road. Workers who live in Burke County can use a number of State highways to reach VEGP, including State Routes 56, 24, and 80 to State Route 23, which connects to River Road (SNC 2007a).

The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)[a] uses the Transportation Research Board's level of service (LOS) classification system, which characterizes operational conditions on a roadway, to describe existing conditions for local transportation networks. The Georgia Department of Transportation makes LOS determinations for roadways involved in specific projects. However, there are no current LOS determinations for the roadways used by VEGP employees residing in Burke, Columbia, or Richmond Counties (SNC 2007a). In Columbia and Richmond Counties, most of the roads have been assigned an "urban" designation, while in Burke County the roads are all designated "rural." Within the three-county area, traffic volumes are highest on roadways in and around the city of Augusta, with annual average daily traffic counts (two-way) of over 62,000 on I-20 and nearly 80,000 on I-520. Traffic volumes in Burke County are highest around Waynesboro, where annual average daily traffic counts range from nearly 3,500 to over 14,000. In the rest of Burke County, annual average daily traffic counts are generally less than 5000. The traffic count locations closest to VEGP are located on State Route 23 west of the site (2570 to 3020) and on River Road to the north (1370) (GDOT 2007).

The three-county region is served by two primary railroads, CSX and Norfolk Southern. Within Burke County, a Norfolk Southern rail line runs from Augusta through Waynesboro. There is rail service to VEGP via a 20-mi spur from that Norfolk Southern line, connecting north of Waynesboro (NRC 2007).

2.2.8.3 Off-site Land Use

VEGP is located in eastern Burke County adjacent to the Savannah River, which is the border between Georgia and South Carolina. Current land use surrounding the VEGP property is primarily forest and agricultural (with a few homes and small farms), including a mixture of row crops and pasture, pine plantations, unused fields, and second-growth forests of hardwoods and mixed pine-hardwoods (SNC 2007a). The nearest permanent residence is located 1.2 miles west-southwest of VEGP (SNC 2007m). Features within the vicinity of VEGP (that is, within a 6-mi radius of the site) are shown in Figure 2-2. The crossroads community of Telfair

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Woods is approximately 5 miles southwest of VEGP. Nearby population centers are the communities of Girard (population 227) and Sardis (population 1171), which are approximately 8 and 12 miles to the south, respectively (USCB 2000b). Waynesboro, 15 miles to the west, is the principal city and county seat of Burke County. The SRS is located directly across the Savannah River from VEGP, in Aiken and Barnwell Counties, South Carolina. It is a large DOE facility with restricted access. The portion of SRS within the VEGP 6-mi radius contains two remediated industrial areas and one fossil-fueled power plant, with the balance of the area forested (SNC 2007a).

Approximately 80 percent of current VEGP employees reside in Burke, Columbia, and Richmond Counties, Georgia. Table 2-18 identifies, for each of the three counties, the acres in each land use category and the percent of the total land area that each category occupies.

Table 2-18. Land Use in Burke, Columbia and Richmond Counties, Georgia

	Burke County (a) (2007)		**Columbia County (b) (2005)**		**Richmond County (c) (2003)**	
Land Uses	**ac**	**% of Total**	**ac**	**% of Total**	**ac**	**% of Total**
Residential	6,877	1.3	110,529	58.3	54,328	25.8
Commercial	997	0.2	2,142	1.1	5,772	2.7
Industrial	545	0.1	2,103	1.1	9,402	4.5
Transportation / Communications / Utilities	3,970	0.8	331	0.2	11,893	5.7
Public / Institutional	2,955	0.6	1,688	0.9	52,890[e]	25.2
Parks / Open Spaces / Conservation	17,063	3.2	2,936	1.6	5,903	2.8
Agriculture / Forestry / Undeveloped [d]	489,845	93.8	69,813	36.8	70,020	33.3
Total	522,352	100	189,542	100	210,208	100.0

(a) Burke County 2007, Figure 3-2

(b) Columbia County 2005

(c) ARCPC 2004, Table L-1

(d) For Burke County only, this category also includes rural residential and "no data".

(e) Includes 44,286 acres at Fort Gordon.

Agriculture/forestry/undeveloped is the primary land use category in each county, in particular Burke County where it occupies 93.8 percent of the total land area.

2.2.8.4 Visual Aesthetics and Noise

Some of the VEGP facility structures can be seen from the immediate surrounding area, which has gently rolling topography. The main vertical components of the VEGP building complex are the natural draft cooling towers (500 feet tall) and the domed reactor containment buildings (180 feet tall). In the vicinity of the site, the cooling towers and the upper portion of the reactor containment can be seen from State Route 56, River Road, and portions of the Savannah River. The plumes, and in some cases the towers themselves, can be seen from across the river in South Carolina in the southern part of Aiken County, in the vicinity of State Highway 125 in Allendale and Barnwell Counties, and along some parts of I-520. The visibility of the plumes is affected by the weather and wind patterns as well as the location of the viewer in relation to local topography (SNC 2007b). Portions of overhead transmission lines are visible, especially as they pass over local roads as well as numerous county, State and U.S. highways on their way to connect to the regional electric power grid. As described in Section 2.1.7 of this draft SEIS, these lines are contained within approximately 360 miles of ROWs that include a total area of approximately 6395 acres.

The VEGP site generates noise, in particular from the cooling towers, transformers and other electrical equipment, circulating water pumps, and public address system. Noise levels produced by VEGP operations have not been directly measured. However, background noise levels were measured at several locations along the site property line in conjunction with the application for the original operating license, and noise emission levels for operating plant conditions have been predicted at those locations. The predicted total noise levels, including background and operational noise, are in the range of 25 to 40 decibels (dBa), which is similar to the average background noise levels of 22 to 39 dBa. Therefore, the noise generated by VEGP operations is expected to decrease to near ambient levels by the time it reaches receptors outside the property boundary (SNC 2007a).

2.2.8.5 Demography

According to the 2000 Census, approximately 43,857 people lived within a 20-mi radius of VEGP, which equates to a population density of 46 persons per square mile (SNC 2007a). This density translates to sparseness Category 2 (40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles) using the GEIS measure of sparseness.

Approximately 670,000 people live within a 50-mi radius of VEGP (SNC 2007a). This equates to a population density of 89 persons per square mile. Applying the GEIS proximity measures, VEGP is classified as proximity Category 3 (one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles). Therefore, according to the sparseness and proximity matrix presented in the GEIS, the VEGP ranks of sparseness

Category 2 and proximity Category 3 result in the conclusion that VEGP is located in a medium population area.

Table 2-19 shows population levels, projections, and growth rates from 1970 to 2050 in Burke, Columbia, and Richmond counties; population for the state of Georgia is provided for comparison. Columbia County experienced the greatest rate of growth of the three counties, with increases of 35 percent to almost 80 percent during the period 1970 to 2000. Except for Columbia County, the ROI has shown lower growth rates than the State as a whole. Beyond 2000, the population is expected to continue increasing, although at a lower rate. One exception is Richmond County, whose population is expected to decrease during the period of 2000 to 2010, after which it is expected to increase moderately.

Table 2-19. Population and Percent Growth in Burke, Columbia and Richmond Counties, Georgia, from 1970 to 2000 and Projected for 2010 to 2050

	Burke County		Columbia County		Richmond County		Georgia	
Year	Population	Percent Growth [a]	Population	Percent Growth [a]	Population	Percent Growth [a]	Population	Percent Growth [a]
1970[b]	18,255	--	22,327	--	162,437	--	4,589,575	--
1980[b]	19,349	6.0	40,118	79.7	181,629	11.8	5,463,105	19.0
1990[b]	20,579	6.4	66,031	64.6	189,719	4.5	6,478,216	18.6
2000[c]	22,243	8.1	89,288	35.2	199,775	5.3	8,186,453	26.4
2010[d]	24,561	10.4	116,642	30.6	193,914	-2.9	9,864,970	20.5
2020[e]	25,649	4.4	138,221	18.5	209,825	8.2	10,898,705	10.5
2030[e]	27,200	6.0	162,001	17.2	217,935	3.9	12,226,119	12.2
2040[e]	28,750	5.7	185,781	14.7	226,045	3.7	13,553,533	10.8
2050[e]	30,301	5.4	209,561	12.8	234,155	3.6	14,880,947	9.8

(a) Percent growth rate is calculated over the previous decade.

(b) USCB 1995

(c) USCB 2000c

(d) State of Georgia 2005

(e) Projected population data for 2020 to 2050 were calculated.

The 2000 demographic profile of the region of influence population is included in Table 2–20. Persons self-designated as minority individuals comprise approximately 45 percent of the combined total population of these three counties. This minority population is composed largely of Black or African American residents who reside in Burke and Richmond counties.

2.2.8.5.1 Transient Population

Within 50 miles (80 kilometers) of VEGP, colleges and recreational opportunities attract daily and seasonal visitors who create demand for temporary housing and services. In 2000 in Burke and Columbia counties, 1.2 and 1.0 percent, respectively, of all housing units are considered temporary housing for seasonal, recreational, or occasional use. By comparison, temporary housing accounts for only 0.4 percent and 0.2 percent of total housing units in Richmond County and Georgia, respectively (USCB 2000b). In 2006, there were approximately 43,700 students attending colleges and universities within 50 miles of VGEP (NCES 2007).

2.2.8.5.2 Migrant Farm Workers

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers may follow the harvesting of crops, particularly fruits and vegetables, throughout the southeastern U.S. rural areas. Others may be permanent residents near VEGP who travel from farm to farm harvesting crops.

Table 2-20. Demographic Profile of the Population in the VEGP Region of Influence

	Burke County	Columbia County	Richmond County	Region of Influence
Total Population (2000)	22,243	89,288	199,775	311,306
Race (2000) (percent of total non-Hispanic population)				
White	47.1	83.3	45.6	56.6
Black or African American	51.5	11.4	50.8	39.5
American Indian and Alaska Native	0.2	0.3	0.3	0.3
Asian	0.2	3.4	1.5	2.0
Native Hawaiian and Other Pacific Islander	0.0	0.1	0.1	0.1
Some other race	0.1	0.2	0.2	0.2
Two or more races	0.9	1.3	1.5	1.4
Ethnicity				
Hispanic or Latino	316	2,313	5,545	8,174
Percent of total population	1.4	2.6	2.8	2.6
Minority Population (including Hispanic or Latino ethnicity)				
Total minority population	11,907	16,850	111,115	139,872
Percent minority	53.5	18.9	55.6	44.9

Source: USCB 2000d

Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting by census takers. If uncounted, these workers would be "underrepresented" in U.S. Census Bureau (USCB) minority and low-income population counts.

Information of migrant workers was collected for the first time in the 2002 Census of Agriculture. Table 2-21 provides information on temporary farm workers, farms with temporary workers, and farms that reported hired workers that are migrant workers. Information is included for the counties within a 50-mi radius of the VEGP site. The counties within the VEGP region host relatively small numbers of migrant workers. According to the 2002 Census of Agriculture estimates, 3478 temporary farm laborers (those working fewer than 150 days per year) were employed on 872 farms in the counties within a 50-mi radius of the VEGP site. The county with the largest number of temporary workers (949 on 76 farms) is Edgefield, in South Carolina. In Georgia, Burke County had the greatest number of temporary workers (258 on 110 farms). Farm operators were asked whether any hired workers were migrant workers, defined as a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day. A total of 87 farms in the VEGP region reported hired migrant workers. Aiken County, South Carolina, had the greatest number of farms (21) with hired migrant workers, followed by Barnwell County, South Carolina, with 16 farms. Only 9 farms in Burke County, Georgia reported hired migrant workers (USDA 2004a and 2004b).

Table 2-21. Farms that Employ Migrant Labor within 50 miles of VEGP [(a)]

County	Total Farms [(b)]	Temporary Workers [(c)]	Farms with Temporary Workers [(d)]	Farms with Hired Migrant Workers [(e)]
Georgia				
Burke	494	258	110	9
Richmond	140	59	20	0
Columbia	196	93	32	0
Jenkins	240	146	45	2
Screven	347	218	83	4
Emanuel	554	219	81	5
Jefferson	388	185	69	1
McDuffie	296	191	37	2
Total	2,655	1,369	477	23
South Carolina				
Aiken	929	229	120	21
Edgefield	325	949	76	9

Table 2-21. (cont'd)

County	Total Farms (b)	Temporary Workers (c)	Farms with Temporary Workers (d)	Farms with Hired Migrant Workers (e)
Allendale	156	190	25	5
Barnwell	370	245	91	16
Bamberg	340	281	42	13
Hampton	248	215	41	0
Total	2,368	2,109	395	64
Region Total	5,023	3,478	872	87

(a) Includes counties with approximately more than half their area within a 50-mi radius of VEGP.
(b) From Table 1 (USDA 2004a and 2004b).
(c) Workers that have worked less than 150 days - from Table 7 (USDA 2004a and 2004b).
(d) Farms with workers that have worked less than 150 days - from Table 7 (USDA 2004a and 2004b).
(e) Migrant farm labor on farms with hired labor - from Table 7 (USDA 2004a and 2004b).

2.2.8.6 Economy

This section contains a discussion of the economy, including employment and income, unemployment, and taxes.

2.2.8.6.1 Employment and Income

Between 2000 and 2006, the civilian labor force in Burke County increased 10.0 percent to the 2006 level of 10,141. The civilian labor force in Columbia County grew 21.1 percent to the 2006 level of 57,433 and in Richmond County the civilian labor force grew 3.5 percent to 90,641 in 2006 (GADL 2007a).

In 2006, employment in the services industry represented the largest sector of employment in all three counties followed closely by government, and the retail trade and manufacturing industries. Southern Nuclear Operating Company, with 862 permanent employees (see Table 2-20), is one of the largest employers in Burke County. The other top five employers in Burke County in 2006 were Brentwood Terrace Health Care, Galaxy Distribution, Health Span Llp, and Wal-Mart Associates Inc (GADL 2007b). Two of the largest employers in the Central Savannah River Area are Fort Gordon (U.S. Army), primarily in Richmond County, with 12,000 military and 5,000 civilian workers (CSRA AFG 2003), and Savannah River Site (U.S. Department of Energy) in South Carolina with 10,700 workers (WSRC 2007).

Income information for Burke, Columbia, and Richmond counties is presented in Table 2–22. Income levels are similar in Burke and Columbia counties. The median household and per capita incomes in Burke and Richmond counties are both well below the Georgia average. Columbia County has income levels that are above the State average and well above the other two counties. In 1999, 28.7 percent of the population in Burke County and 19.6 percent in Richmond County were living below the official poverty level, while in Columbia County only 5.1 percent of the population was living below the poverty level. In comparison, the State average was 13.0 percent living below the poverty level (USCB 2000a).

Table 2-22. Income Information for the VEGP Region of Influence

	Burke County	Columbia County	Richmond County	Georgia
Median household income 1999 (dollars)	27,877	55,682	33,086	42,433
Per capita income 1999 (dollars)	13,136	23,496	17,088	21,154
Percent of persons below the poverty line (2000)	28.7	5.1	19.6	13.0

Source: USCB 2000a

2.2.8.6.2 Unemployment

In 2006, the annual unemployment average in Burke and Richmond counties were 6.7 and 6.2 percent, respectively, which were higher than the annual unemployment average of 4.1 and 4.6 percent, respectively, for Columbia County and Georgia (USCB 2007c).

2.2.8.6.3 Taxes

VEGP pays annual real estate taxes to Burke County. From 2000 through 2007, SNC and the VEGP site's co-owners paid between $23.7 and $25.3 million annually in property taxes to Burke County (see Table 2–23). This represented between 74 and 82 percent of the county's total annual tax revenue. Each year, Burke County retains a portion of this tax money for county operations and disburses the remainder to the state, the school district, and fire/emergency management/public safety services to fund their respective operating budgets. As shown in Table 2-23, the local public school system, Burke County School District, receives approximately 60 percent of the total county property tax revenue (SNC 2007a and Burke County Tax Commission 2008).

At present, the State of Georgia has taken no action on deregulation, which could, if enacted, affect tax payments to Burke County. However, any changes to VEGP property tax rates due to deregulation would be independent of license renewal.

Tax payments from SNC and VEGP are a major source of income to Burke County and the School District operating budgets. Any changes to this revenue stream would affect their ability to invest in infrastructure and to attract industry and new residents.

Table 2-23. Property Tax Information for Burke County (2000-2006)

Year	Total Burke County Property Tax Revenue	Burke County Tax Revenue Disbursed to the Burke County School District	Property Tax Paid by SNC and VEGP Co-Owners ($)	Percent of Total Property Taxes Paid by SNC and VEGP Co-Owners
2000	30,329,024	19,116,331	24,930,927	82.2
2001	30,758,563	18,691,850	25,276,404	82.2
2002	29,713,972	18,022,492	23,699,476	79.8
2003	30,029,880	18,160,393	24,341,247	81.1
2004	29,805,738	17,838,847	24,358,042	81.7
2005	30,963,918	18,266,740	23,737,300	76.7
2006	31,922,862	18,929,556	24,457,550	76.6
2007	34,138,733	19,437,324	25,348,161	74.3

Sources: 2000 to 2004 data from SNC 2007a; 2005 to 2007 data from Burke County Tax Commission 2008.

2.2.9 Historic and Archaeological Resources

This section presents a brief summary of the region's cultural background and a description of known historic and archaeological resources at the VEGP site and its immediate vicinity. Information was collected from area repositories, the Georgia and South Carolina State Historic Preservation Offices (SHPO), and the applicant's Early Site Permit Application (SNC 2007b).

2.2.9.1 Cultural Background

Prehistoric Overview

Paleoindian Period (13,000 to 9,000 Years Ago)

Paleoindian people in the southeastern United States ranged over large areas of land traveling in small bands. Early Paleoindian groups are thought to have lived in small centralized communities for varying periods throughout the year. Over the course of the Paleoindian era, occupation of fixed communities gave way to foraging, with bands frequently moving their camps as they exhausted the food supply in their immediate area (Anderson and Sassman, 1996). No large Paleoindian sites have been excavated in Georgia to date and very few Paleoindian sites have been excavated in the Savannah River drainage (Anderson and Sassman, 1996).

Archaic Period (9,000 to 3,000 Years Ago)

Early Archaic people were hunters and gatherers who, generally, lived a nomadic life. They traveled in small groups or "bands" of twenty to fifty people hunting wild game and collecting seasonal and perennial edible flora (O'Steen et. al., 2002). They erected small, simple shelters located close to water sources and food resources, however, there is little archaeological evidence that they stored food or remained in settlements for extended periods (Kane and Keeton, 1993).

It is believed that the climate of the southeastern United States was significantly drier and warmer during the Middle Archaic Period than it is today. The Paleoindian subsistence pattern of hunting and gathering continued through the Middle Archaic, with very little change from the preceding period (O'Steen et. al., 2002). It is thought that, due to the expanding territories of rival bands, Middle Archaic people began to rely more on locally available resources (Kane and Keeton, 1993). At present, no long-term Middle Archaic habitation sites have been found in Georgia.

During the Late Archaic Period, people in Georgia were drawn to the rivers and other major water sourses by the abundance of subsistence resources. As territories began to shrink in size some groups built semi-permanent settlements along the rivers and their tributaries (O'Steen et. al., 2002). One of the best examples of an Archaic riverine site is the Stallings Island site on the Savannah River near Augusta, about 30 miles upriver from the VEGP site.

Woodland Period (3,000 to 1,200 Years Ago)

This period witnessed the development of many subsistence and technological trends that had their genesis during the preceding Late Archaic Period. During the Woodland Period, people began to develop more settlements, increased their social stratification, and developed more elaborate rituals and ceremonies (Pluckhan, 2003). Horticulture gained importance during the Woodland Period as growing populations increased the need for food resources. Additionally, during this period people used local plants for food with increasing regularity (Kane and Keeton, 1993).

The Early Woodland subperiod is marked by a continuation of many of the innovations that began during the preceding Late Archaic. Most settlements from this period were very small and were likely only used on a seasonal basis (Pluckhan, 2003). The reliance on horticulture increased during this period.

During the Middle Woodland subperiod settlements appear to have become larger and more permanent. Archaeological evidence indicates that shelters were more sturdily constructed and appear to have been built to last for long periods of time (Kane and Keeton, 1993). The Middle

Woodland subperiod gave rise to an increase in ritual and ceremonialism as evidenced by the earthen and rock mounds constructed in Georgia during this time (Pluckhan, 2003).

The Late Woodland subperiod saw diminished mound construction that some attribute to a decrease in population (Kane and Keeton, 1993). The increase in corn agriculture during the Late Woodland subperiod and technological advances in weaponry set the stage for the final period in Georgia prehistory, the Mississippian Period (Pluckhan, 2003).

Mississippian Period (1,200. to 550 Years Ago)

The Mississippian Period witnessed the development of some of the most socially and technologically complex aboriginal societies that ever existed in North America (King, 2002). During the Middle Mississippian subperiod in Georgia, populations were organized into chiefdoms that were centered around large mound towns (King 2002). Horticulture thrived during this period as people planted large crops in the fertile soil that lined the watercourses of the Southeastern United States (Kane and Keeton, 1993). Near the end of this period, from 1539 to 1543, Hernando Desoto and his army of Spaniards traveled through the Southeast in search of riches.

Historic Overview

Since prehistoric times, the Savannah River has been used as a major transportation route between the Atlantic Coast and the Piedmont (SNC 2007b). Burke County is one of Georgia's eight original counties and was known as the Halifax District at the time the Georgia colony was established in 1732 (Cooksey, 2007). In 1758 Georgia was divided into parishes, and the Halifax District became the parish of St. George. Burke County was formed from St. George Parish in 1777 and was named for Edmund Burke, an English spokesman for American liberty. The county currently encompasses an area of 831 square miles after portions of it were incorporated into Screven (1793), Jefferson (1796), Richmond (1841), and Jenkins (1905) counties (Cooksey, 2007).

Most of the county's early settlers came from the older American colonies to the north. They were enticed by the proximity to the Savannah and Ogeechee Rivers, which provided transportation and water for their livestock (Cooksey, 2007). By the mid-eighteenth century Georgia had lifted its ban on slavery and greater numbers of settlers began to flood into Burke County. By the end of the eighteenth century, a plantation system had been established and Burke County became a prime cotton producing area. By the end of the Civil War many of the plantations were destroyed and production of cotton shifted to a small farm system using tenant labor (Cooksey, 2007).

Edward Telfair, who was Georgia's governor from 1786 to 1791, was the largest landowner in the vicinity of VEGP in the late eighteenth century. By 1830 the U.S. census shows no Telfair landowners in the VEGP area, however, several landowners named Utl[e]y began to appear

(SNC 2007b). The first Utley to own land in the area is said to have been an overseer for Governor Telfair. Today, several features on the VEGP property bear the name Utley.

2.2.9.2 Historic and Archaeological Resources at the VEGP Site

Previously Identified Resources

Resources in the Vicinity of the VEGP Site

The National Register of Historic Places (NRHP) lists seven sites in Burke County (NRHP 2008). The closest NRHP listed site to VEGP is the Sapp Plantation, about 10 miles to the south of the plant site. The Savannah River Site (SRS), a cold war-era nuclear materials processing center located directly across the Savannah River from VEGP, is considered eligible for NRHP listing. The SRS property also contains 22 recorded archaeological sites that have been determined eligible for NRHP listing.

Shell Bluff Landing, approximately 7 miles north northwest of the VEGP site, has both historic and prehistoric significance. It was the site of the original grave of Dr. Lyman Hall, a signer of the Declaration of Independence, and was important during the era of steamboat river traffic (GPC 1972). Shell Bluff was named for an Eocene-era fossil bed of giant oysters (Crassostreagigantissima). A prehistoric village site containing Archaic Period artifacts is located between Shell Bluff and Boggy Gut Creek, approximately 7.5 miles upstream of VEGP (GPC 1972).

Resources on the VEGP Site

In the early 1970's, prior to construction at the VEGP site, an archaeological assessment was conducted and submitted to the U.S. Atomic Energy Commission (Honerkamp, 1973). A total of seven archaeological sites were identified, four along the river bluff, two on the plateau west of Mallard Pond, and one in the location currently occupied by a barge slip. At the time of that study, the State Archaeologist considered the archaeological resources of the VEGP site to have been sufficiently characterized and did not recommend further work.

In 2005 and 2006 a partial survey of the VEGP site was conducted by New South Associates (NSA) to assess potential impacts of the construction of new units. (NSA 2006a and 2006b) This survey work identified 17 archaeological sites (3 historic and 14 prehistoric) and 8 isolated finds. None of the seven sites identified during the 1972 survey were observed during the 2005 - 2007 survey effort. Of the 17 new archaeological sites identified during the 2005 - 2006 effort, two are considered eligible (9BK416 and 9BK423) and two potentially eligible (9BK419 and 9BK420) for listing on the NRHP. Two additional sites, 9BK421 and 9BK422, were said to require further evaluation (NSA 2006a and b). In June of 2007 modifications to the proposed water intake structure necessitated additional testing in the vicinity (NSA 2007). No new sites were recorded during the course of this survey, however, further testing near site 9BK416 confirmed that it is a multi-component prehistoric site, eligible for NRHP listing. NSA recommended that the site be avoided.

Potential Archaeological Resources

Due to disturbances associated with site preparation and construction, the main generating station area has little or no potential for archaeological resources. There are other areas within the VEGP property that appear to have been only minimally disturbed and are comprised of landforms that may have been attractive during prehistory for varied resource exploitation. Archaeological surveys conducted in 2005 and 2006 demonstrated potential for archaeological resources to be present in the portions of the VEGP property that have not been disturbed by previous construction activity (NSA 2006a, 2006b). These surveys identified several historic and prehistoric archaeological sites, including two prehistoric sites that have been determined NRHP eligible. Additionally, several NRHP eligible archaeological sites have been recorded immediately across the Savannah River from the plant property at the SRS in South Carolina.

2.2.10 Related Federal Project Activities and Consultations

The NRC staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating licenses for VEGP. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparation of this draft SEIS.

The NRC staff has reviewed Federally owned facilities in the local area near Waynesboro and Augusta, Georgia, and has determined that there are no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparing this draft SEIS. The known Federal projects in the area are the operation of three reservoirs by the USACE (Hartwell, Richard B. Russell, and J. Strom Thurmond) and operation of the SRS by the DOE.

NRC is required under Section 102(c) of the National Environmental Policy Act of 1969, as amended to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. NRC consulted with the National Marine Fisheries, FWS, NOAA, EPA, and USACE. No comments were submitted by these agencies during the scoping process.

2.3 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, Energy, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 61. Code of Federal Regulations, Title 10, *Energy,* Part 61, "Licensing requirements for land disposal of radioactive waste."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy,* Part 71, "Packaging and transportation of radioactive material."

16 U.S.C. Section 1531 to 1544. "Endangered Species Act of 1973" (16 U.S.C. 1531-1544, 87 Stat. 884), as amended. Public Law 93-205, approved December 28, 1973.

32 FR 4001. Secretary of the Interior. "Native Fish and Wildlife, Endangered Species." Federal Register Notice. March 11, 1967.

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of areas for air quality planning purposes."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

40 CFR Part 261. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 261, "Identification and Listing of Hazardous Waste."

40 CFR Part 273. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 273, "Standards for Universal Waste Management."

49 FR 7332. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; U.S. Breeding Population of the Wood Stork Determined To Be Endangered." Final Rule. February 28, 1984.

51 FR 6690. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Determination of *Oxypolis canbyi* (Canby's Dropwort) To Be an Endangered Species." Final Rule. February 25, 1986.

52 FR 21059. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Reclassification of the American Alligator to Threatened Due to Similarity of Appearance Throughout the Remainder of its Range." Final Rule. June 4, 1987.

53 FR 10879. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Relict Trillium." Final Rule. April 4, 1988.

57 FR 46340. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; *Echinacea laevigata* (Smooth Coneflower) Determined To Be Endangered." Final Rule. October 8, 1992.

64 FR 15691. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Final Rule To List the Flatwoods Salamander as a Threatened Species." April 1, 1999.

72 FR 5856. U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Flatwoods Salamander; Proposed Rule". February 7, 2007.

72 FR 37346. U. S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants: Removing the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife." Final rule. July 9, 2007.

Academy of Natural Sciences (ANS). 2001. *2000 Savannah River Biological Surveys for Westinghouse Savannah River Company*. Prepared by the Patrick Center for Environmental Research of The Academy of Natural Sciences, Philadelphia, PA. Report No. 01-16F. September 30.

Academy of Natural Sciences (ANS). 2003. *2001 Savannah River Biological Surveys for Westinghouse Savannah River Company*. Prepared by the Patrick Center for Environmental Research of The Academy of Natural Sciences, Philadelphia, PA. Report No. 03-08F. August 1.

Academy of Natural Sciences (ANS). 2005. *2003 Savannah River Biological Monitoring Studies for the Westinghouse Savannah River Company*. Prepared by The Academy of Natural Sciences, Philadelphia, PA. Report No. F04-06. February 14.

Anderson, David G. and Kenneth E. Sassaman, eds.1996. *The Paleoindian and Early Archaic Southeast*. Tuscaloosa: University of Alabama Press.

Augusta-Richmond County Planning Commission (ARCPC). 2004. Augusta-Richmond County Comprehensive Plan. February 17, 2004. Accessed at: http://www.augustaga.gov/departments/planning_zoning/comp_plan.asp on December 31, 2007.

Atlantic States Marine Fisheries Commission (ASMFC). 1990. "Fishery Management Report No. 17 of the Atlantic States Marine Fisheries Commission: Fishery Management Plan for the Atlantic Sturgeon." Washington, D.C. November.

Atlantic States Marine Fisheries Commission (ASMFC). 2000. "Interstate Fishery Management Plan for American Eel." Fishery Management Report No. 36 of the Atlantic States Marine Fisheries Commission, Washington, DC.

Bailey, M. M., J. I. Isley, and W. C. Bridges. 2004. "Movement and Population Size of American Shad Near a Low-head Lock and Dam." Transactions of the American Fisheries Society, 133(2): 300-308.

Burke County. 2007. *Burke County Comprehensive Plan 2007-2027; Part I: Draft Community Assessment.* MACTEC Engineering and Consulting, Inc. March 2007. Accessed at: http://www.dca.state.ga.us/development/PlanningQualityGrowth/programs/downloads/plans/BurkeCoComAsse.PDF on December 31, 2007.

Burke County Tax Commission. 2008. "Tax Digest – Real and Personal Property," facsimile transmissions from Cynthia McManus, Burke County Tax Commissioner, to E. Schreiber, Earth Tech, January 18, 2008.

CSRA Alliance for Fort Gordon (CSRA AFG). 2003. "The Economic Impact of Fort Gordon." Accessed at http://fortgordonalliance.com/economic_impact.htm on January 3, 2008.

Central Savannah River Area Regional Development Center (CSRARDC). 2005. *Central Savannah River Area Regional Plan 2005-2025, Technical Staff Report, Regional Community Facilities Element*. March 2005. Accessed at: http://www.csrardc.org/csra/planning/planning_search_results.asp on December 27, 2007.

Columbia County. 2005. *Columbia County Growth Management Plan Update: Community Assessment*. EDAW. Accessed at: www.columbiacountyga.gov/Modules/ShowDocument.aspx?documentid=2959 on December 31, 2007.

Conant, R. and J. T. Collins. 1998. *A Field Guide to Reptiles and Amphibians, Eastern and Central North America.* Third edition, expanded. Houghton Mifflin Co., Boston.

Cooksey, Elizabeth B. 2007. *Overview of Burke County, Georgia from The New Georgia Encyclopedia.* Accessed at :http://www.georgiaencyclopedia.org/nge/Article.jsp?id=h-2301&sug=y on November 13, 2007.

Creel, M. 2005. “Striper moratorium to end Oct. 1 on lower Savannah River.” South Carolina Department of Natural Resources news release dated July 11, 2005. Available online at http://www.outdoorcentral.com/mc/pr/05/07/11a2a.asp.

Eco-Sciences. 2007. "Jurisdictional Waters Report, Vogtle Electric Generating Plant." In *Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Response to Requests for Additional Information on the Environmental Report.* Letter report from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington, D.C.). Accession number ML0760460323. January.

Environmental Protection Agency (EPA). 2006. Green Book. Accessed at: http://www.epa.gov/air/oaqps/greenbk/ancl.html on August 10, 2007.

Environmental Protection Agency (EPA). 2007. “Safe Drinking Water Information System (SDWIS)”, October 12, 2007. Accessed at: http://epa.gov/enviro/ on December 28, 2007.

Environmental Systems Research Institute (ESRI). 2002. Data and maps on CD-ROM. Redlands, California.

Facey, D.E., and M.J. Van Den Avyle. 1987. “Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic) – American Eel.” U.S. Fish and Wildlife Service Biological Report 82(11.74). U.S. Army Corps of Engineers, TR EL-82-4. 28pp.

Fish and Wildlife Service (FWS). 1986. *Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Lindera Melissifolia.* Federal Register 51: 27495-27500.

Fish and Wildlife Service (FWS). 1990a. *Canby's Dropwort Recovery Plan.* Atlanta, Georgia. 25 pp.

Fish and Wildlife Service (FWS). 1990b. *Recovery Plan for Relict Trillium (Trillium reliquum Freeman).* Atlanta, Georgia. 29 pp.

Fish and Wildlife Service (FWS). 1995. *Smooth Coneflower Recovery Plan.* Atlanta, Georgia. 31 pp.

Fish and Wildlife Service (FWS). 1997. *Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork.* Atlanta, Georgia.

Fish and Wildlife Service (FWS). 2001a. "Candidate Conservation Agreement with Assurances and Permit Application for a Proposed Reintroduction of the Robust Redhorse." *Federal Register*, Volume 66, Number 210, pg. 54776-54778.

Fish and Wildlife Service (FWS). 2003a. *Recovery Plan for the Red-Cockaded Woodpecker (Picoides borealis).* Second Revision, Atlanta, Georgia. 296 pp.

Fish and Wildlife Service (FWS). 2004. "Listed Species in Georgia Counties." Accessed at http://www.fws.gov/athens/endangered/countiesendangered html on December 19, 2007.

Fish and Wildlife Service (FWS). 2007a. "Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the American Eel as Threatened or Endangered." *Federal Register*, Vol. 72 No. 22, pp. 4967. Washington, D.C. February 2.

Fish and Wildlife Service (FWS). 2007b. *Wood Stork (Mycteria americana), 5-Year Review: Summary and Evaluation.* Fish and Wildlife Service, Jacksonville, Florida.

Fish and Wildlife (FWS). 2008a. "The American Eel: Considering Endangered Species Act Protection." Accessed at: http://www.fws.gov/northeast/ameel/ on January 3, 2008.

Flora of North America (FNA) Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ vols. New York and Oxford. Accessed at: http://www.efloras.org/flora_page.aspx?flora_id=1 on February 5, 2008.

Georgia Department of Transportation (GDOT). 2007. "Annual Traffic Counts, 2006 Annual Average Daily Traffic Report (AADT)." Office of Transportation Data. Accessed at: http://www.dot.state.ga.us/DOT/plan-prog/transportation_data/traffic_counts/index.shtml on November 14, 2007.

Georgia Department of Labor (GADL). 2007a. "Yearly Average Labor Force Estimates." Georgia LaborMarket Explorer. Accessed at: http://explorer.dol.state.ga.us/mis/laus_yearly.htm on January 3, 2008.

Georgia Department of Labor (GADL). 2007b. "Local Area Profiles." Georgia LaborMarket Explorer. Accessed at: http://explorer.dol.state.ga.us/mis/profiles.htm on January 3, 2008.

Georgia Department of Natural Resources (GDNR). 2004. Georgia Environmental Radiation Surveillance Report 2000-2002.

Georgia Department of Natural Resources (GDNR). 2007a. "Striped Bass Harvest Now Allowed in the Savannah River." Press Release. Accessed at: http://georgiawildlife.dnr.state.ga.us/content/displaypressrelease.asp?ArticleID=831on August 7, 18 2007.

Georgia Department of Natural Resources (GDNR). 2007b. "Commercial Freshwater Fishing, A Guide to the Laws and Regulations on Commercial Freshwater Fishing." Accessed at: http://georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=9 on December 27, 2007.

Georgia Department of Natural Resources (GDNR). 2007c. "Guidelines for Eating Fish from Georgia Waters, 2007 Update." Atlanta, Georgia. Accessed at http://gaepd.org/Files_PDF/gaenviron/fish_advisory/GADNR_FishConsumptionGuidelines_Y2007.pdf on February 26, 2008.

Georgia Department of Natural Resources (GDNR). 2007d. "Locations of Special Concern Animals, Plants, and Natural Communities" by county. Accessed at: http://georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=89&txtPage=9 on December 19, 2007.

Georgia Department of Natural Resources (GDNR). 2008. "Georgia Rare Species and Natural Community Information." Accessed at: http://www.georgiawildlife.com/content/displaycontent.asp?txtDocument=89 on January 3, 2008.

Georgia Environmental Protection Division (GEPD). 2004. Environmental Radiation Surveillance Report 2000-2002 (published March 2004). Atlanta, Georgia. Accessed at: http://www.gaepd.org/Files_PDF/gaenviron/radiation/radrpt2002.pdf on December 19, 2007.

Georgia Environmental Protection Division (GEPD). 2005. *List of Municipal and Industrial Ground Water Withdrawal Permittees*. Revised September 2005. Accessed at: http://www.gaepd.org/Documents/regcomm_wpb.html on January 2, 2008.

Georgia Environmental Protection Division (GEPD). 2007. *List of Municipal and Industrial Surface Water Withdrawal Permittees*. Revised June 2007. Accessed at: http://www.gaepd.org/Documents/regcomm_wpb.html. January 2, 2008.

Georgia Power Company (GPC). 1972. *Alvin W. Vogtle Nuclear Power Plant, Applicant's Environmental Report*. Georgia Power Company, Atlanta, Georgia.

Georgia Power Company (GPC). 1997. "Maintenance of Plant Vogtle Transmission Line Corridors." Georgia Power Transmission Bulletin Number 6-10. Atlanta, Georgia. May 8.
Georgia Rivers LMER, 2007. Accessed at: http://lmer.marsci.uga.edu/index.html on December 31, 2007.

Gotvald, A.J., J.T. Fisher, C.E. Oberst, and D.L. Calhoun. 2005. Water Resources Data-Georgia. Volume 1: Continuous water-level, streamflow water-quality, and periodic water-quality data. Water Year 2004. B.E. McCallum and D.V. Alhadeff (compilers): Reston, Va., U.S. Geological Survey Water Data Report GA 04-1.

Governor's Office of Student Achievement (GOSA). 2007. "Annual Education Accountability Report Cards, 2006 – 2007 Report Card." Accessed at: http://reportcard2007.gaosa.org/ on December 28, 2007.

Grabowski, T. B. and J. J. Isely. 2006. "Seasonal and Diel Movements and Habitat Use of Robust Redhorses in the Lower Savannah River, Georgia and South Carolina." Transactions of the American Fisheries Society, Volume 135, Issue 5, September.

Haro, A., W. Richkus, K. Whalen, A. Hoar, W. Busch, S. Lary, T. Brush, and D. Dixon. 2000. "Population Decline of the American Eel: Implications for Research and Management." *Fisheries,* 25:7-16.

Hendricks, A.S. 2000. "The Conservation and Restoration of the Robust Redhorse, *Moxostoma robustum*, Volume 2." Georgia Power Company, Environmental Laboratory, Smyrna, GA. Prepared for the Federal Energy Regulatory Commission. April.

Hendricks, A.S. 2002. "The Conservation and Restoration of the Robust Redhorse, *Moxostoma robustum*, Volume 3." Georgia Power Company, Environmental Laboratory, Smyrna, GA. Prepared for the Federal Energy Regulatory Commission. May.

Honerkamp N. 1973. *Archaeological Field Survey of the Alvin W. Vogtle Nuclear Plant Property Plant in Burke County, Georgia.* Submitted to L.H. Larson, Jr., Georgia State Archaeologist, Atlanta, Georgia.

Kane, Sharyn and Richard Keeton. 1993. *Beneath These Waters* Atlanta: National Park ervice. Accessed at: http://www.nps.gov/history/seac/beneathweb/btw-index.htm

Kemper Center for Home Gardening. 2008. Accessed at: http://www.mobot.org/ on February 5, 2008.

King, Adam. 2002. *The Mississippian Period Overview from The New Georgia Encyclopedia.* Accessed at: http://www.georgiaencyclopedia.org/nge/Article.jsp?path=/HistoryArchaeology/Archaeologyand EarlyHistory/ArchaeologicalPeriodsinGeorgia/PaleoindianPeriod&id=h-707
Lady Bird Johnson Wildflower Center Native Plant Information Network (NPIN). 2008. Accessed at: http://www.wildflower.org/ on February 5, 2008.

Marcy, B.C., D. E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. The University of Georgia Press, Athens, Georgia.

McCord, J.W. 2004. "American Eel (*Anguilla rostrata*)." Species account prepared for South Carolina Department of Natural Resources. Available online at http://www.dnr.sc.gov/cwcs/pdf/AmericanEel.pdf.

McFarlane R.W., R.F. Frietsche and R.D. Miracle. 1978. *Impingement and Entrainment of Fishes at the Savannah River Plant. An NPDES 316b Demonstration.* DP-1494, E.I. Du Pont DE Nemours and Company, Savannah River Laboratory, Aiken, South Carolina.

Meyer J., M. Alber, W. Duncan, M Freeman, C. Hale, R. Jackson, C. Jennings, M. Palta, E. Richardson, R. Sharitz, J. Sheldon, and R Weyers. 2003. *Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam.* Summary Report 6/03. University of Georgia, River Basin Center. Accessed at: http://www.rivercenter.uga.edu/publications/pdf/summaryreport.pdf on January 2, 2008.

National Center for Education Statistics (NCES). 2007. "College Navigator." Institute of Education Sciences, U.S. Department of Education. Accessed at: http://nces.ed.gov/collegenavigator/ on December 11, 2007.

National Marine Fisheries Service (NMFS). 1998. *Recovery Plan for the Shortnose Sturgeon* (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages.

National Marine Fisheries Service (NMFS). 2006. *Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species, October 1, 2004 – September 30, 2006.* National Oceanic and Atmospheric Administration. Accessed at http://nmfs.noaa.gov/pr/pdfs/laws/esabiennial2006.pdf on February 6, 2008.

National Marine Fisheries Service (NMFS). 2007. "Species of Concern: Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*." November 1. Accessed at http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_detailed.pdf on January 6, 2008.

National Oceanic and Atmospheric Administration (NOAA). 2004. *Local Climatological Data – Annual Summary With Comparative Data – Atlanta and Augusta, GA ISSN 0198-2419,* Asheville, NC 2004.

National Oceanic and Atmospheric Administration (NOAA). 2007. "Shortnose Sturgeon (*Acipenser brevirostrum*)." Office of Protected Resources, NOAA Fisheries. Accessed at: http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm on December 31, 2007.

National Park Service (NPS). 2006a. Explore Air. Class I Receptors. Accessed at: http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm, on June 5, 2006.

National Park Service (NPS). 2006b. Explore Air. Class I Receptors. Accessed at: http://www2.nature.nps.gov/air/Maps/images/ClassIAreas.jpg , on August 10, 2007.

National Register of Historic Places (NRHP). 2008. Accessed at: http://www.nationalregisterofhistoricplaces.com/GA/Burke/state.html

Natural Resources Conservation Service (NRCS), Plants Database. 2008. United States Department of Agriculture (USDA). Accessed at: http://plants.usda.gov/java/factSheet on February 5, 2008.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life (web application). Version 6.2. NatureServe, Arlington, Virginia. Accessed at: http://www.natureserve.org/explorer/ in February 2008.

New South Associates (NSA). 2006a. *Intensive Archaeological Survey of the Proposed Expansion Areas at the Vogtle Electric Generating Plant, Burke County, Georgia.* New South Associates, Stone Mountain, Georgia.

New South Associates (NSA). 2006b. *Addendum Report: Intensive Archaeological Survey of the Proposed Expansion Areas at the Vogtle Electric Generating Plant, Burke County, Georgia.* New South Associates, Stone Mountain, Georgia.

New South Associates (NSA). 2007. *Addendum Report: Phase 1 Archaeological Survey of the Water Line Corridor for the Proposed Intake Structure at Plant Vogtle.* New South Associates, Stone Mountain, Georgia.

Nuclear Regulatory Commission (NRC). 1985. *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2. NUREG-1087, Washington, DC.*

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2007. *Draft Environmental Impact Statement For the Early Site Permit for Two Additional Reactors at the Vogtle Electric Generating Plant.* Docket Nos. 50-424 and 50-425, Georgia Power Company, et al. Washington, D.C. August.

O'Steen, Lisa D., Ledbetter Gerald R., and Daniel T. Elliot. 2002. *The Archaic Period Overview from The New Georgia Encyclopedia.* Accessed at: http://www.georgiaencyclopedia.org/nge/Article.jsp?id=h-580

Pluckhahn, T. J. 2003. *The Woodland Period Overview from The New Georgia Encyclopedia.* Accessed at: http://www.georgiaencyclopedia.org/nge/Article.jsp?id=h-811.

Reed, M. B., M. T. Swanson, S. Gaither, J. W. Joseph, and W. R. Henry. 2002. *Savannah River Site at Fifty.* U. S. Government Printing Office. Accessed at: www.srs.gov/general/about/50anniv/50anniv.htm on February 5, 2008.

Reinert, T. R., C. A. Jennings, T. A. Will, and J. E. Wallin. 2005. "Decline and Potential Recovery of Striped Bass in a Southeastern U.S. Estuary. *Fisheries* 30 (3): 18-25.

Robert W. Freckmann Herbarium. 2008. University of Wisconsin-Stevens Point, Wisconsin Plants web site. Accessed at: http://wisplants.uwsp.edu on February 5, 2008.

Robust Redhorse Conservation Committee (RRCC). 2008. Robust Redhorse Conservation Committee website. Accessed at http://www.robustredhorse.com/ on February 22, 2008.

Self, R. L. and J. Bettinger. 2006. "Highest Conservation Priority – Big River Species: Highfin Carpsucker *Carpiodes velifer*, Robust Redhorse *Moxostoma robustum*." *Comprehensive Wildlife Conservation Strategy*, South Carolina Department of Natural Resources, Columbia, SC. Accessed at www.dnr.sc.gov/cwcs/species.html on February 26, 2008.

South Atlantic Fishery Management Council (SAFMC). 1998. *Final Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council.* October.

South Carolina Department of Health and Environmental Control (SCDHEC). 2007. "2007 South Carolina Fish Consumption Advisories." Bureau of Water, Columbia, South Carolina. Accessed at http://www.scdhec.gov/environment/water/fish/advisories.htm on February 26, 2008.

South Carolina Department of Natural Resources (SCDNR). 2007. "South Carolina Rare, Threatened, & Endangered Species Inventory" by county. Accessed at: http://www.dnr.sc.gov/pls/heritage/county_species.list on December 20, 2007.

South Carolina Department of Natural Resources (SCDNR). 2008. "South Carolina Rare, Threatened, & Endangered Species Inventory," species maps by quadrangle. Accessed at: http://www.dnr.sc.gov/pls/heritage/species.qselect?pfilename on January 3, 2008.

South Carolina Department of Natural Resources (SCDNR). Undated. Canby's Dropwort. Accessed at:http://www.dnr.sc.gov/marine/mrri/acechar/specgal/dropwort.htm on February 20, 2008.

Southern Company. 2007. Information about Plant Vogtle. Accessed at: http://www.southerncompany.com/southernnuclear/vogtle.asp on December 13, 2007.

Southern Nuclear Operating Company (SNC). 2003a. Offsite Dose Calculation Manual (ODCM) included as Appendix A in Southern Nuclear Operating Company Vogtle Electric Generating Plant - Units 1 and 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1, 2002 to December 31, 2002. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2003b. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2002. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2004a. Southern Nuclear Operating Company Vogtle Electric Generating Plant- Units 1 and 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1, 2003 to December 31, 2003. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2004b. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2003. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2005a. Southern Nuclear Operating Company Vogtle Electric Generating Plant- Units 1 and 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1, 2004 to December 31, 2004. Burke County, Georgia.

Southern Nuclear Operating Company, Inc. (SNC). 2005b. Vogtle Electric Generating Plant Updated Final Safety Analysis Report, Revision 13. January 31, 2005.

Southern Nuclear Operating Company (SNC). 2005c. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2004. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2006a. Vogtle Electric Generating Plant- Units 1 and 2, Final Safety Analysis Report Revision 13. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2006b. Southern Nuclear Operating Company Vogtle Electric Generating Plant- Units 1 and 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1, 2005 to December 31, 2005. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2006c. "Vogtle Electric Generating Plant Early Site Permit Application, Part 3 -Environmental Report." Public Disclosure Version.

Southern Nuclear Operating Company, Inc. (SNC). 2006d. "Cooling Water Blowdown Thermal Discharge Analysis for Plant Vogtle Early Site Permit Facility." Southern Company, Birmingham, Alabama. Accession No. ML063000221.

Southern Nuclear Operating Company, Inc. (SNC). 2006e. "Wildlife Habitat Council 2006 Recertification Application for Vogtle Electric Generating Plant." *Found in Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Response to Requests for Additional Information on the Environmental Report.* Letter report from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington, D.C.). Southern Company, Birmingham, Alabama. Accession number ML0760460323.

Southern Nuclear Operating Company, Inc. (SNC). 2006f. "Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Environmental Site Audit Information Needs." December 11, 2006, Letter Report from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington, D.C.), Southern Company. Birmingham, Alabama. Accession No. ML063520382.

Southern Nuclear Operating Company (SNC). 2006g. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2005. Burke County, Georgia.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant, Units 1 and 2. Docket Numbers 50-424 and 50-425.*

Southern Nuclear Operating Company, Inc. (SNC). 2007b. *Southern Nuclear Operating Company, Vogtle Early Site Permit Application: Environmental Report, Rev. 2.* Southern Company, Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 2007c. Southern Nuclear Operating Company Vogtle Electric Generating Plant- Units 1 and 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1, 2006 to December 31, 2006. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2007d. Vogtle Electric Generating Plant- Units 1&2 Conceptual Design for a Low Level Radwaste Pad at Plant Vogtle, April 30, 2007. Burke County, Georgia. (ML073240339)

Southern Nuclear Operating Company (SNC). 2007e. Enclosure 2 to NL-07-2097. Monthly Surface Water Withdrawal Reports, 2006. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company (SNC). 2007f. Enclosure 2 to NL-07-2097. Groundwater Use Permit 017-0003. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company (SNC). 2007g. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2006.

Southern Nuclear Operating Company (SNC). 2007h. Enclosure 2 to NL-07-2097. Annual Environmental Operating Reports (Nonradiological). Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company (SNC). 2007i. Enclosure 2 to NL-07-2097. Quarterly Operational Monitoring Reports, NPDES Permit GA0026786. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company (SNC). 2007j. Enclosure 2 to NL-07-2097. Groundwater Monitoring Plan for Radionuclides. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company (SNC). 2007k. Enclosure 2 to NL-07-2119. Groundwater Monitoring Report, Plant Vogtle Landfill #2, Solid Waste Permit Nos. 017-006D(L)(I). Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2119. November 12, 2007.

Southern Nuclear Operating Company (SNC). 2007l. Enclosure 2 to NL-07-2119. Groundwater Monitoring Report, Plant Vogtle Landfill #3, Solid Waste Permit Nos. 017-007D(L)(I). Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2119. November 12, 2007.

Southern Nuclear Operating Company (SNC). 2007m. Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2006. Burke County, Georgia.

State of Georgia. 2005. *Georgia 2015; Population Projections*. Office of Planning and Budget – Policy, Planning, and Technical Support. Accessed at: http://www.opb.state.ga.us/ on December 28, 2007.

Stier, D.J. and J.H. Crance. 1985. "Habitat Suitability Index Models and Instream Flow Suitability Curves: American Shad." U.S. Fish and Wildlife Service Biological Report 82(10.88). 34 pp.

The Center for Plant Conservation. 2008. Accessed at: http://www.centerforplantconservation.org/ on February 5, 2008.

Third Rock Consultants (TRC). 2006. *Threatened and Endangered Species Survey Final Report, Vogtle Electric Generating Plant and Associated Transmission Corridors.* January 16.

Trails.com, 2007. Brier Creek: GA 56 to Savannah River. Accessed at: http://www.trails.com/tcatalog_trail.asp?trailid=CGD036-012 on December 31, 2007.

U.S. Army Corps of Engineers (USACE). 1996. *Water Control Manual: Hartwell, Richard B Russell, and J. Strom Thurmond Projects.* Savannah River Basin, Savannah River District, U.S. Army Corps of Engineers, Savannah, Georgia.

U.S. Army Corps of Engineers (USACE). 2006. *Drought Contingency Plan Update: Savannah River Basin. Draft Environmental Assessment.* Mobile/Savannah Planning Center, Savannah River District, U.S. Army Corps of Engineers, Savannah, Georgia.

U. S. Army Corps of Engineers (USACE). 2007a. Concepts of the Savannah River Basin Drought Contingency Plan. Accessed at: http://water.sas.usace.army.mil/drought/dcp.cfm on December 24, 2007.

U. S. Army Corps of Engineers (USACE). 2007b. Thurmond Reservoir Pool Elevation. Accessed at: http://water.sas.usace.army.mil/cf/KavaPlot/KPlotAction2.cfm on December 24, 2007.

U. S. Army Corps of Engineers (USACE). 2007c. Thurmond Reservoir Outflow Data. Accessed at: http://water.sas.usace.army.mil/cf/DataQuery/QueryActionTab.cfm on December 24, 2007.

U.S. Army Corps of Engineers (USACE). 2008. Threatened and Endangered Species of the Upper Savannah River Basin. Accessed at: http://www.sas.usace.army.mil/prtillm.htm.

U.S. Census Bureau (USCB). 1995. *Population of Counties by Decennial Census: 1900-1990.* Accessed at: http://www.census.gov/population/cencounts/ga190090.txt on December 28, 2007.

U.S. Census Bureau (USCB). 2000a. "Fact Sheets: Census 2000 Demographic Profile Highlights"; Burke, Columbia, and Richmond Counties, Georgia, and South Carolina." Accessed at: http://factfinder.census.gov on December 27, 2007.

U.S. Census Bureau (USCB). 2000b. "DP-1. Profile of General Demographic Characteristics: 2000. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data." Accessed at: http://factfinder/census.gov on December 26, 2007.

U.S. Census Bureau (USCB). 2000c. "P1. Total Population [1] – Universe: Total Population. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data." Accessed at: http://factfinder.census.gov/ on December 28, 2007.

U.S. Census Bureau (USCB). 2000d. "P4. Hispanic or Latino, and not Hispanic or Latino by Race [73] – Universe: Total population. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data." Accessed at: http://factfinder.census.gov/. Accessed January 3, 2008.

U.S. Census Bureau (USCB). 2007a. GCT-T1. Population Estimates, Georgia – County and South Carolina – County. Accessed at: http://factfinder/census.gov. January 2, 2008.

U.S. Census Bureau (USCB). 2007b. "State & County QuickFacts, Burke County, Georgia."

U.S. Census Bureau (USCB). 2007c. "MapStats" for Burke, Columbia, and Richmond Counties and Georgia. MapStats from FedStats, last revised July 2007. Accessed at: http://www.fedstats.gov/qf/13/ on January 3, 2008.

U.S. Department of Agriculture (USDA). 2004a. *2002 Census of Agriculture; Georgia, State and County Data, Volume 1, Geographic Area Series, Part 10.* National Agricultural Statistics Service. Accessed at: http://www.nass.usda.gov/census/census02/volume 1/ga/index2.htm on December 31, 2007.

U.S. Department of Agriculture (USDA). 2004b. *2002 Census of Agriculture; South Carolina, State and County Data, Volume 1, Geographic Area Series, Part 40.* National Agricultural Statistics Service. Accessed at: http://www.nass.usda.gov/census/census02/volume 1/sc/index2.htm on December 31, 2007.

United States Department of Agriculture (USDA), Forest Service Fire Effects Information System. 2008. Accessed at: http://www.fs.fed.us/database/feis/plants/index.html on February 5, 2008.

University of Georgia (UGA) Carl Vinson Institute of Government. 2006. Balancing Insteam and Offstream Uses: Instream Flows, Surface Storage and Aquifer Management. A Report to the Georgia Environmental Protection Division. Athens, Georgia.

U.S. Geological Survey (USGS). 2002. *Water Resources Data, South Carolina: Water Year* 2002, Water-Data Report SC-02-1, U.S. Geological Survey, U.S. Department of the Interior, Washington, D.C.

U.S. Geological Survey (USGS). 2007a. Savannah River Flow near Waynesboro, Georgia. Accessed at: http://waterdata.usgs.gov/nwis/dv/ on December 4, 2007.

U.S. Geological Survey (USGS). 2007b. Drought Watch - USGS State Information on Drought. Accessed at: http://water.usgs.gov/waterwatch on September 14, 2007.

U.S. Geological Survey (USGS). 2007c. Savannah River Flow near Augusta, Georgia. Accessed at: http://waterdata.usgs.gov/nwis/dv on December 24, 2007.

U.S. Geological Survey (USGS). 2007d. Savannah River Flow, Annual Statistics, near Augusta, Georgia. Accessed at: http://waterdata.usgs.gov/nwis/annual on December 24, 2007.

U.S. Geological Survey (USGS). 2007e. Georgia Internet Map Server Applications. Accessed at: http://ga-ims.er.usgs.gov/website/drg24/viewer.htm on December 27, 2007.
University of South Florida (USF), Institute for Systematic Biology, Atlas of Florida Vascular Plants. 2008. Accessed at: http://www.plantatlas.usf.edu/ on February 5, 2008.

Weiss-Glanz, L.S., J.G. Stanley, and J.R. Moring. 1986. "Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic) – American Shad." U.S. Fish and Wildlife Service Biological Report, 82(11.59). U.S. Army Corps of Engineers, TR EL-82-4. 16 pp.

Westinghouse Savannah River Company, Inc. (WSRC). 2007. *Savannah River Site Environmental Report for 2006*, WSRC–TR–2007–00008.

Wike, L. D. 1998. "Potential Effect of Increased SRS River Water Withdrawal on the Savannah River Shortnose Sturgeon Population." WSRC-TR-98-00424. Westinghouse Savannah River Company, Aiken, South Carolina.

Wike L.D., F.D. Martin, E.A. Nelson, N.V. Halverson, J.J. Mayer, M.H. Paller, R.S. Riley, M.G. Serrato, and W.L. Specht. 2006. *SRS Ecology: Environmental Information Document.* WSRC-TR-2005-00201. Prepared for the U.S. Dept. of Energy by Washington Savannah River Company, Savannah River Site, Aiken, South Carolina. March.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris and R.J. Neves. 1993. Conservations status of freshwater mussels of the United States and Canada. Fisheries. 18(9):6-22.

Wiltz J.W. 1982a. *Vogtle Electric Generating Plant, Beaverdam Creek Resident Fish Study, Burke County, Georgia from January 1977 through December 1978.* Operating License Stage Environmental Report Technical Document, Georgia Power Company, Environmental Affairs Center, Atlanta, Georgia.

Wiltz J.W. 1982b. *Vogtle Electric Generating Plant, Beaverdam Creek Anadromous Fish Study, Burke County, Georgia from March 1977 through May 1978,* Operating License Stage. Environmental Report Technical Document, Georgia Power Company, Environmental Affairs Center, Atlanta, Georgia.

World Book Encyclopedia. 2006. *Georgia Climate*, Chicago, IL.

3.0 Environmental Impacts of Refurbishment

Environmental issues associated with refurbishment activities are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this draft Supplemental Environmental Impact Statement (SEIS) unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1; therefore, additional plant-specific review of these issues is required.

License renewal actions may require refurbishment activities for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment that were determined to be Category 1 issues are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS for which these conclusions could not be reached for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Table 3-1. Category 1 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Impacts of refurbishment on surface water quality	3.4.1
Impacts of refurbishment on surface water use	3.4.1
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Refurbishment	3.5
GROUND-WATER USE AND QUALITY	
Impacts of refurbishment on ground-water use and quality	3.4.2
LAND USE	
Onsite land use	3.2
HUMAN HEALTH	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

Category 1 and Category 2 issues related to refurbishment that are not applicable to Vogtle Electric Generating Plant (VEGP) because they are related to plant design features or site characteristics not found at VEGP are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Southern Nuclear Operating Company, Inc. (SNC) indicated that it has performed an evaluation of structures and components pursuant to Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 54.21 to identify activities that are necessary to continue operation of VEGP during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities, and are described in the Environmental Report (SNC 2007).

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53 (c)(3)(ii) Subparagraph
TERRESTRIAL RESOURCES		
Refurbishment impacts	3.6	E
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)		
Threatened or endangered species	3.9	E
AIR QUALITY		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
SOCIOECONOMICS		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services, education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services, transportation	3.7.4.2	J
Historic and archaeological resources	3.7.7	K
ENVIRONMENTAL JUSTICE		
Environmental justice	Not addressed[a]	Not addressed[a]

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the applicant's environmental report and the Staff's environmental impact statement. The Commission issued a Final *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* in 2004 (NRC 2004).

However, VEGP stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (NRC 1985). In addition, SNC's evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of VEGP beyond the end of the existing operating licenses. Therefore, refurbishment is not considered in this draft SEIS.

3.1 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

Nuclear Regulatory Commission (NRC). 1985. *Final Environmental Statement Related to Operation of Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425, Georgia Power Company et al., Washington, DC.

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, *"Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register* Volume 69, pp. 52040-52048. Washington, DC August 24, 2004.

Southern Nuclear Operating Company, Inc. (SNC). 2007. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425.

4.0 Environmental Impacts of Operation

Environmental issues associated with operation of a nuclear power plant during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1 and, therefore, additional plant-specific review of these issues is required. Eleven of 12 Category 2 issues related to operational impacts during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this chapter of the draft Supplemental Environmental Impact Statement (SEIS). The twelfth Category 2 issue, which involves the severe accident mitigation alternatives, is addressed Chapter 5.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B and are applicable to Vogtle Electric Generating Plant (VEGP). Section 4.1 addresses issues applicable to the VEGP cooling system. Section 4.2 addresses issues related to transmission lines and on-site land use. Section 4.3 addresses the radiological impacts of normal operation and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was identified during the scoping period and Section 4.8 discusses cumulative impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to VEGP because they are related to plant design features or site characteristics not found at VEGP are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to VEGP cooling system operation, during the renewal term, are listed in Table 4-1. Southern Nuclear Operating Company (SNC) stated in its Environmental Report (SNC 2007a) that it is not aware of any new and significant information associated with the renewal of the VEGP operating licenses. The U.S. Nuclear Regulatory Commission (NRC) staff also has not identified any new and significant information during its independent review of the SNC Environmental Report, the Staff's site audit, the scoping process, or evaluation of other available information. For all of the Category 1 issues, the Staff concluded in the GEIS that the impacts would be SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-1. Category 1 Issues Applicable to the Operation of the VEGP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1; 4.3.2.2; 4.4.2
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.2.2
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.2.2
Eutrophication	4.2.1.2.3; 4.4.2.2
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2
Discharge of other metals in wastewater	4.2.1.2.4; 4.3.2.2; 4.4.2.2

Table 4-1. (cont'd)

AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.2.2; 4.4.3
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER-BASED HEAT DISSIPATION SYSTEMS)	
Entrainment of fish and shellfish in early life stages for plants with cooling tower heat dissipation systems	4.3.3
Impingement of fish and shellfish in early life stages for plants with cooling tower heat dissipation systems	4.3.3
Heat shock for plants with cooling tower heat dissipation systems	4.3.3
TERRESTRIAL RESOURCES	
Cooling tower impacts on crops and ornamental vegetation	4.3.4
Cooling tower impacts on native plants	4.3.5.1
Bird collisions with cooling towers	4.3.5.2
HUMAN HEALTH	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

A brief description of the Staff's review and the GEIS conclusions, as codified in Table B-1, for each of these Category 1 issues follows:

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that:

> Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- <u>Temperature effects on sediment transport capacity</u>. Based on information in the GEIS, the Commission found that:

> The GEIS determined that there is no evidence that temperature effects on sediment transport capacity have caused adverse environmental effects at any existing plant, and that it is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts from temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

- <u>Scouring caused by discharged cooling water</u>. Based on information in the GEIS, the Commission found that:

> Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- <u>Eutrophication</u>. Based on information in the GEIS, the Commission found that:

> Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, review of monitoring programs, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that:

  > Effects are not a concern among regulatory and resource agencies and are not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information including the National Pollutant Discharge Elimination System (NPDES) permit for VEGP. Therefore, the Staff has determined that there would be no significant impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that:

  > Effects are readily controlled through the NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information including the NPDES permit for VEGP. Therefore, the Staff has determined that there would be no significant impacts of discharge of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in wastewater. Based on information in the GEIS, the Commission found that:

  > These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information including the NPDES permit for VEGP. Therefore, the Staff concludes that there would be no impacts of discharges of other metals in wastewater during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that:

  Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.

  No non-radiological analysis of sediment or biota samples is required by the Annual Environmental Operating Program (SNC 2007b).

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of available information. Therefore, the Staff concludes that there would be no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that:

  Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, review of monitoring programs, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that:

  Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that:

  > Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, review of monitoring programs, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts on distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that:

  > Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that:

  > Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, review of monitoring programs, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that:

  > Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, review of monitoring programs, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that:

  > These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the Staff's site visit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that:

  > Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Entrainment of fish and shellfish in early life stages for plants with cooling tower heat dissipation systems. Based on information in the GEIS, the Commission found that:

    In general, the relatively small volumes of water used for cooling tower-based cooling systems result in low levels of entrainment, and as a result, cooling tower systems are often recommended as a mitigation measure to reduce impacts from entrainment. Based on reviews of literature, operational monitoring reports, consultations with utilities and regulators, and comments on the draft GEIS, the GEIS concluded that entrainment had not been shown to cause reductions in aquatic populations associated with any plant with a closed-cycle cooling system.

    The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts due to entrainment of fish and shellfish in early life stages during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish for plants with cooling tower heat dissipation systems. Based on information in the GEIS, the Commission found that:

    In general, the relatively small volumes of water used for cooling tower-based cooling systems result in low levels of impingement, and as a result, cooling tower systems are often recommended as a mitigation measure to reduce impacts from impingement. Based on reviews of literature, operational monitoring reports, consultations with utilities and regulators, and comments on the draft GEIS, the GEIS concluded that impingement had not been shown to cause reductions in aquatic populations associated with any plant with a closed-cycle cooling system.

    The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts due to impingement of fish and shellfish during the renewal term beyond those discussed in the GEIS.

- Heat shock for plants with cooling tower heat dissipation systems. Based on information in the GEIS, the Commission found that:

> In general, the relatively small volumes of water used for cooling tower-based cooling systems result in low levels of heat shock, and as a result, cooling tower systems are often recommended as a mitigation measure to reduce impacts from heat shock. Based on reviews of literature, operational monitoring reports, consultations with utilities and regulators, and comments on the draft GEIS, the GEIS concluded that heat shock had not been shown to cause reductions in aquatic populations associated with any plant with a closed-cycle cooling system.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts due to heat shock during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on crops and ornamental vegetation. Based on information in the GEIS, the Commission found that:

> The GEIS evaluated the potential for cooling tower operations to impact crops and ornamental vegetation due to exposure to salts, ice, or increased humidity. The analysis revealed no instances where cooling tower operations had caused measurable productivity losses to crops or damage to ornamental vegetation. Therefore, this is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no cooling tower impacts on crops or ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on native plants. Based on information in the GEIS, the Commission found that:

> The GEIS evaluated the potential for cooling tower drift to native vegetation in the vicinity of nuclear power plants due to exposure to salts, ice, or increased humidity. The analysis revealed no instances where cooling tower operations had caused measurable degradation of the health of natural plant communities. Therefore, this is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no cooling tower impacts on native plants during the renewal term beyond those discussed in the GEIS.

- Bird collisions with cooling towers. Based on information in the GEIS, the Commission found that:

    The GEIS evaluated avian mortality studies from plants with natural draft cooling towers, and concluded that the mortality occurred in sufficiently small numbers that it was unlikely that the losses would threaten the stability of native populations, or impair the function of these species within the local ecosystems. Therefore, this is not expected to be a problem during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts due to bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that:

    Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of microbiological organisms on occupational health during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that:

    Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of noise during the license renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to VEGP are discussed in the sections that follow, and are listed in Table 4-2.

Table 4-2. Category 2 Issues Applicable to the Operation of the VEGP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	Draft SEIS Section
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Water use conflicts (plants with cooling towers and cooling ponds using makeup water from a small river with low flow)	4.3.2.1; 4.4.2.1	A	4.1.1
HUMAN HEALTH			
Microbiological organisms (public health) (plants using a lake, canal, or cooling towers or cooling ponds that discharge to a small river)	4.3.6	G	4.1.2

4.1.1 Water Use Conflicts

For plants with cooling tower systems that are supplied with make-up water from a small river with low flow, the potential impact on instream and riparian communities is considered a Category 2 issue, thus requiring a site-specific assessment for license renewal review. Since 1953 (the year of the opening of the J. Strom Thurmond Dam), the mean annual flow volume of the Savannah River at Augusta (22 miles [mi] upstream from VEGP) has ranged from 4,470 to 16,580 cubic feet per second (cfs; USGS 2007a). This volume meets the NRC definition of a small river of 100,000 cfs (3.15 X 10^{12} cubic feet per year [ft^3/yr] listed in 10 CFR Part 51.53(c)(3)(ii)(A)), resulting in water use conflicts being a potentially applicable issue for relicensing of VEGP.

In order to evaluate potential impacts related to water withdrawal from the Savannah River, and the potential for impacts to instream and riparian communities associated with the Savannah River, the Staff independently reviewed the VEGP Environmental Report, visited the site, consulted with Federal and State resource agencies, and reviewed the applicant's existing NPDES permit and other existing literature.

The GEIS considered surface water use conflicts to be a Category 2 issue for two separate reasons:

1) Consumptive water use can adversely affect riparian vegetation and instream aquatic communities in the stream. Reducing the amount of water available to either the riparian zones or instream communities could result in impacts to threatened and endangered species, wildlife, and recreational uses of the water body. In addition, riparian vegetation performs several important ecological functions, including stabilizing channels and floodplains, influencing water temperature and quality, and providing habitat for aquatic and terrestrial wildlife (NRC 1996).

2) Continuing operation of these facilities depends on the availability of water within the river from which they are withdrawing water. For facilities that are located on small bodies of water, the volume of water available is expected to be susceptible to droughts and to competing water uses within the basin. In cases of extreme drought, these facilities may be required to curtail operations if the volume of water available is not sufficient (NRC 1996).

An additional potential effect of the withdrawal of water from a small river is that the withdrawal may have an impact on groundwater levels and, therefore, result in groundwater use conflicts (NRC 1996). This is considered to be a separate Category 2 issue, and is evaluated in Section 4.5.2 of this draft SEIS.

The VEGP facility withdraws water from the Savannah River for use as make-up water to the cooling tower system. The water is withdrawn under a Georgia Department of Natural Resources (GDNR) permit, Number 017-0191-05, which currently expires in 2010 (SNC 2007a). The permitted volume of water withdrawal under this permit is 131 cfs (85 million gallons per day [mgd] monthly average; GDNR 2007a). The VEGP Environmental Report reports that the actual capacity of the intake system is 89 cfs (SNC 2007a), of which an estimated 66.8 cfs is consumed through evaporative loses and drift (NRC 1985). The actual surface water withdrawal reports provide a different estimate. In 2006, the highest average monthly withdrawal rate was in May, with a daily average of 67.26 mgd (103.8 cfs; SNC 2007c). Using the same consumption ratio reported in the Environmental Report (75 percent), this would translate to an average consumptive use of 77.9 cfs.

The hypothetical minimum flow volume in the river during the most extreme drought is projected to be 957 cfs (SNC 2006a), but this estimate was based on river conditions before the construction of the reservoirs. In reality, the most likely minimum flow volume in the Savannah River would be 3,800 cfs, which is the minimum volume that is to be released from Thurmond Dam, if the water level in the reservoir remains above 312 feet (ft) above mean sea level (msl; USACE 2007). The water level in the reservoir has never dropped that low. There have been days on which the flow volume was less then 3,800 cfs; these have been isolated events (USGS 2007b). Although the state of Georgia is currently considered to be in a period of severe drought (USGS 2007c), the flow volume at the Waynesboro measuring station has not dropped below 3,900 cfs since measurements began in early 2005 (USGS 2007d).

Based on these values, the highest volume that is expected to be consumed by facility operations (77.9 cfs) represents about 2.05 percent of the lowest expected flow volume (3,800 cfs), and only 8 percent of the hypothetical minimum flow volume. This withdrawal is not expected to represent a volume large enough to adversely affect riparian vegetation and instream aquatic communities in the Savannah River. In addition, it does not appear that flow volumes in the Savannah River, even under the current severe drought conditions, could be reduced to the point where it would affect facility operations. In the unlikely event that drought conditions reduced flow volumes even further, the facility could continue to operate at flow volumes down to 500 cfs (SNC 2006a). At this volume, VEGP consumptive water use would still represent only about 15 percent of the flow volume in the river. Therefore, the Staff has determined that impacts associated with future water use conflicts are SMALL.

The staff identified a variety of measures that could mitigate potential water use impacts resulting from continued operation of VEGP cooling water system. Potential mitigation measures for the effects of the cooling water system on water use impacts include reduction in the use of river water, or additional recycling of cooling water. These mitigation measures could reduce water use impacts by reducing the consumptive use of water within the Savannah River.

The staff did not identify any cost benefit studies applicable to these mitigation measures. The volume of consumptive water use for the facility is authorized under a Permit to Withdraw, Divert, or Impound Surface Water issued by the Georgia Environmental Protection Division (GEPD), and NRC expects that analysis of the costs and benefits of any mitigation measures would be evaluated by GEPD as part of that permitting program.

4.1.2 Microbiological Organisms (Public Health)

The effects of thermophilic microbiological organisms on human health are listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as a Category 2 issue and require plant-specific evaluation before license renewal for those plants with closed-cycle cooling on a small river. The average annual flow of the Savannah River at the nearest measuring station to VEPG (Augusta, at river mile [RM] 187.4) is approximately 2.89×10^{11} t^3/yr (8.2×10^9 cubic meters per year [m^3/yr]) (Gotvald et al. 2005). This is less than the 3.15×10^{12} ft^3/yr (9×10^{10} m^3/yr) threshold value in 10 CFR 51.53(c)(3)(ii)(G) for thermal discharge to a small river. Nevertheless, recreational uses of the Savannah River in the vicinity of the plant, which include boating, fishing, and canoeing, create the potential for human exposure to thermophilic microbiological organisms. Hence, the effects of the VEGP cooling water discharge on microbiological organisms must be addressed for VEPG license renewal.

The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of enteric pathogens such as *Salmonella* spp. and *Shigella* spp., the *Pseudomonas aeruginosa* bacterium, the pathogenic strain of the free-living amoebae *Naegleria* spp., and a number of species from genus *Legionella* (NRC 1996). Thermophilic biological organisms generally occur at temperatures of 77 to 176 degrees Fahrenheit (°F) (25 to 80 degrees Celsius [°C]), with optimal growth occurring between 122 and 150°F (50 and 66°C) and minimum tolerance of 68°F (20°C) (Joklik and Willett 1976). However, thermal preferences and tolerances vary across bacterial groups. Pathogenic thermophilic microbiological organisms that are of concern in nuclear power reactor operation typically have optimal growing temperatures of approximately 99°F (37°C) (Joklik and Smith 1972).

Pseudomonas aeruginosa is an opportunistic pathogen that causes serious and sometimes fatal infections in immuno-compromised individuals by producing and releasing toxins. It has an optimal growth temperature of 99°F (37°C) (Todar 2007). The genus *Legionella* consists of at least 46 species and 70 serogroups and is responsible for Legionnaires' disease, which begins with the onset of pneumonia in the first two weeks of exposure. Risk groups for *Legionella* spp. include the elderly, cigarette smokers, persons with chronic lung or immuno-compromising disease, and persons receiving immuno-suppressive drugs. *Legionella* spp. grow best at 90 to 105°F (32 to 41°C) (CDC 2007a). *Salmonella typhimurium* and *S. enteritidis* are two of the more common species of Enterobacteriaceae that cause fever, abdominal cramps, and diarrhea. *Salmonella* spp. can occasionally establish localized infection (e.g., septic arthritis) or progress to sepsis. All ages can be affected, but groups at greatest risk for severe or complicated disease include infants, the elderly, and persons with compromised immune systems. *Salmonella* spp. occur at temperatures between 50 and 120°F (10 and 49°C) (Aserkoff et al. 1970; CDC 2007b), with optimal growth occurring at 95 to 99°F (35 to 37°C) (ESR 2002). The pathogenic amoeba flagellate *Naegleria fowleri* is the causative agent of human primary amoebic meningoencephalitis (PAM). All ages can be affected, but groups at greatest risk for severe or complicated disease include infants, the elderly, and persons with compromised immune systems. *Naegleria* spp. are ubiquitous in nature and can be enhanced in thermally altered water bodies at temperatures ranging from 95 to 106°F (35 to 41°C) or higher, but this organism is rarely found in water cooler than 95°F (35°C), and infection rarely occurs at this water temperature (Tyndall et al. 1989).

The maximum temperature of the discharge stream (below the discharge outfall) in the summer is approximately 92°F (33.4°C) with a maximum ambient river temperature of 79°F (26.1°C) (NRC 1985). As described in the NUREG-1437 (NRC 1996), nuclear power plants that use cooling ponds, lakes, or canals and those that discharge to "small rivers" have the greatest chance of affecting the public by increases in thermophilic microbiological organism populations. A small river is defined as one with a monthly average flow rate of less than 2,800 cubic meters per second (cms) (100,000 cfs). The annual average flow rate of the Savannah River at the nearest measuring station to VEPG (Augusta, at RM 187.4) is approximately 2.89×10^{11} ft^3/yr

(8.2×10^9 m^3/yr), which equates to 259 cms (9,146 cfs) (Gotvald et al. 2005). The monthly average flow rates of the Savannah River between the years 1985 and 2005 ranged from about 200 to 400 cms (7,000 to 14,000 cfs), which meets the criterion of a small river (SNC 2007b). The average cooling tower blowdown flow rate from current operation is about 5,000 gallons per minute (11.4 cfs), per unit. This flow rate equates to 10,000 gallons per minute (22.8 cfs) for the VEPG site (SNC 2007b). This flow rate is less than 1 percent of the minimum monthly average flow rate of the Savannah River. Thus, at a given volume of the discharge stream with a maximal temperature of 92°F (33.4°C), there will be approximately 100 equivalent diluting volumes of Savannah River water with a maximal temperature of 79°F (26.1°C). The Zeroth Law of Thermodynamics dictates that when a higher temperature system comes in physical contact with a lower temperature system, there will be a net transfer of heat from the higher temperature system to the lower temperature system. This happens until the two systems have reached thermal equilibrium (Adkins 1984). Therefore, when the discharge stream temperature is at its maximum and the ambient Savannah River water is at its maximum, the temperature range of the Savannah River (below the discharge outfall) would be between 79°F (26.1°C) and 92°F (33.4°C) (NRC 1985). This temperature range is well outside the optimal growth temperature range of thermophilic microbiological organisms between 99°F and 150°F (37 and 66°C), and is not expected to cause any significant public health risks.

SNC consulted the South Carolina Department of Health and Environmental Control (SCDHEC), Aquatic Biology Section, to determine whether there was any concern about the potential occurrence of thermophilic microbiological organisms in the Savannah River at the VEPG location (SNC 2007a). The SCDHEC has indicated that it currently does not monitor for *N. fowleri* in the waters of the State of South Carolina and no information is available from SCDHEC concerning the potential health effects in South Carolina associated with *N. fowleri* and its associated disease (SNC 2007a).

Available data assembled by the U.S. Centers for Disease Control and Prevention (CDC) for the years 1996 to 2005 (CDC 1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2005, 2006, 2007c), and from the States of Georgia and South Carolina for the years 2001 to 2006 (GDHR 2002, 2006; SCDHEC 2007), report a single occurrence of a waterborne disease in August 2002 resulting in one fatality. The environmental investigation of this incident revealed that it occurred under extreme environmental conditions of high ambient air and water temperatures, low river water level, and low river flow rate. During 1989 to 2000, the CDC waterborne-disease outbreak surveillance system documented 24 fatal cases of PAM in the United States, this being the first case in Georgia since 1987 (CDC 2002b). Outbreaks of Legionellosis, Salmonellosis, or Shigellosis that occurred in Georgia or South Carolina were within the range of national trends (CDC 1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2005, 2006, 2007c) in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes.

Epidemiological reports from the States of Georgia and South Carolina indicate a very low risk of causing outbreaks from thermophilic microbiological organisms associated with thermal discharges (GDHR 2002, 2006; SCDHEC 2007). Notably, there have been up to 40 cases per year of Legionellosis reported statewide in Georgia during the last 10 years and only one case of exposure to *N. fowleri* reported statewide during the last 5 years. During the period 2004 to 2006, counties in Georgia within the vicinity of VEGP reported Legionellosis in Jefferson County (6 cases) and Chatham County (9 cases), with no cases reported in Burke, Columbia, Emanuel, Effingham, Jenkins, McDuffie, Richmond, or Screven Counties. In South Carolina, up to 22 cases per year of Legionellosis have been reported statewide since 1995. For the South Carolina counties in the vicinity of VEGP, Aiken County reported one case in 2004, and Barnwell County reported one case in 2006, with no cases reported in Allendale, Edgefield, Hampton, or Jasper Counties during 2003 to 2006. No reported cases of exposure to *N. fowleri* in South Carolina were identified during the last 5 years (SCDHEC 2007).

The Staff independently reviewed the VEPG Environmental Report (SNC 2007a) and visited the VEPG site. Based on the evaluation presented above, thermophilic microbiological organisms are not likely to present a public health hazard as a result of VEPG's discharges to the Savannah River. The Staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of VEPG in the license renewal period would be SMALL.

The staff identified a variety of measures that could mitigate potential thermophilic microbiological organism impacts resulting from continued operation of the VEPG. These mitigation measures would include periodically monitoring for thermophilic microbiological organisms in the water and sediments near the discharge, as well as not allowing recreational use near the discharge plume. These mitigation measures could reduce human health impacts by minimizing public exposures to thermophilic microbiological organisms. The staff did not identify any cost benefit studies applicable to these mitigation measures

4.2 Transmission Lines

The seven transmission lines and right-of-ways (ROWs) built in conjunction with the VEGP site are described in section 2.1.7 and mapped on figure 2-4. The lines total 395 mi (636 kilometers [km]) in length, and have ROW widths varying from 100 ft (30.5 meters [m]) to 275 ft (84 m). The transmission lines operate with 500-kilovolt (kV) lines and 230-kV lines. The transmission line ROWs include a total area of 6395 acres (ac) (2588 hectares [ha]) (SNC 2007a).

SNC maintains the ROW with established procedures to prevent vegetation from interfering with the lines (GPC 1997). The vegetative maintenance program includes selected backpack spraying of approved herbicides on dry ground and stream crossings every other year; SNC follows a four-year mowing cycle in non-spraying years (SNC 2007a; TRC 2006). On wetland areas, no herbicides are used, the area is not mowed, and only hand clearing is allowed.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to transmission lines from VEGP are listed in Table 4-3. The NRC staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or evaluation of other available information that would indicate any new and significant information associated with the renewal of the VEGP operating licenses. Therefore, the Staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the Staff concluded in the GEIS that the impacts would be SMALL.

Table 4-3. Category 1 Issues Applicable to the VEGP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Floodplains and wetland on power line ROW	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
On-site land use	4.5.3
Power line right-of-way	4.5.3

A brief description of the Staff's review and GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Power line ROW management (cutting and herbicide application). Based on information in the GEIS, the Commission found that:

  > The impacts of ROW maintenance on wildlife are expected to be of small significance at all sites.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, consultation with the U.S. Fish and Wildlife Service (FWS), or evaluation of other information. Therefore, the Staff concludes that there would be no impacts of power line ROW maintenance on wildlife during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that:

  > Impacts are expected to be of small significance at all sites.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, consultation with the U.S. Fish and Wildlife Service, or evaluation of other information. Therefore, the Staff concludes that there would be no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that:

  > No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, or evaluation of other information. Therefore, the Staff concludes that there would be no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetlands on power line right of way. Based on information in the GEIS, the Commission found that:

  > Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, or evaluation of other information. Therefore, the Staff concludes that there would be no impacts of power line ROW maintenance on floodplains and wetlands during the renewal term beyond those discussed in the GEIS.

- Air quality effects of transmission lines. Based on the information in the GEIS, the Commission found that:

  Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, or evaluation of other information. Therefore, the Staff concludes that there would be no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- On-site land use. Based on the information in the GEIS, the Commission found that:

  Projected on-site land use changes required during the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, or evaluation of other information. Therefore, the Staff concludes that there would be no on-site land use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right of way (ROW). Based on information in the GEIS, the Commission found that:

  Ongoing use of power line ROWs would continue with no change in restrictions. The effects of these restrictions are of small significance.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007a), the site audit, the scoping process, or evaluation of other information. Therefore, the Staff concludes that there would be no impacts of power line ROWs on land use during the renewal term beyond those discussed in the GEIS.

Two Category 2 issues exist for the transmission lines. The issue of chronic effects was not categorized in the GEIS, but is being treated as a Category 2 issue in this draft SEIS. The Category 2 issues are listed in Table 4-4 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-4. Category 2 and Uncategorized Issues Applicable to the VEGP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	HUMAN HEALTH		
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	NA	4.2.2

4.2.1 Electromagnetic Fields-Acute Effects

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this draft SEIS.

In the GEIS (NRC 1996), the Staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC; NESC 1997) criteria, it was not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents. An analysis of the conformance of the VEGP transmission lines with the NESC standard was conducted using computer modeled data of induced current under the transmission lines. Objects located near the transmission lines can become electrically charged due to their immersion in the electromagnetic field surrounding the lines. This electrical charge results in a current that flows through the object to the ground. This current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the electrically charged object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, with the magnitude of the current depending upon several factors. These factors include the strength of the electric field (dependent on the voltage of the transmission line and its height and geometry), the size of the object on the ground, and the extent to which the object is grounded (SNC 2007a).

As described above, two 500-kV and five 230-kV transmission lines were built to distribute power from VEGP to the electric grid. SNC began its analysis of these lines by identifying the limiting case for each line; that is, the configuration along each line where the potential for induced-current shock would be greatest. Once the limiting case was identified, the electric field strength for each transmission line was calculated, then the induced current was calculated. SNC calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute. The results of this program have been field-verified through actual electrostatic field measurements by several utilities. The input parameters for the ACDCLINE program included the design features of the limiting-case scenario, the NESC requirement that line sag be determined at a conductor temperature of 120°F, and the maximum vehicle size under the lines (a tractor-trailer). The analysis determined that none of the transmission lines has the capacity to induce greater than 5 milliamperes in a vehicle parked beneath the lines (Table 4-5). Therefore, the VEGP transmission lines conform to the NESC provisions for preventing electric shock from induced current (SNC 2007a).

SNC also analyzed hypothetical spans of a generic 230-kV transmission line and a generic 500-kV transmission line terminating at the VEGP facility (GPC 1997 in SNC 2007a). These hypothetical cases represented the most extreme condition expected on each type of line. Table 4-5 includes the results of these generic analyses (SNC 2007a).

Georgia Power Company (GPC) and Georgia Transmission Corporation, the owners of the transmission lines, have surveillance and maintenance procedures that provide assurance that design ground clearances will not change. These procedures include routine aerial inspections that check for evidence of clearance problems, including encroachments, broken conductors, broken or leaning structures, and signs of burning trees. In addition, ground-level inspections include examination of clearances at questionable locations, evaluation of the integrity of structures, and surveillance for dead or diseased trees that may fall on the lines. Problems noted during any inspection are identified for corrective action by the appropriate organization (SNC 2007a).

Table 4-5. Results of Induced Current Analysis

Transmission Line	Voltage (kilovolts)	Induced Current[a] (milliamperes)
Scherer	500	4.7
West McIntosh (Thalmann)	500	4.3
Goshen (Black)	230	1.5[b]
Goshen (White)	230	1.5[b]
Augusta Newsprint	230	2.0
SCE&G	230	2.1
Wilson	230	na[c]
Generic 500-kV line[d]	500	4.7
Generic 500-kV line[d]	230	1.4

(a) Conservatively calculated for 212°F sags for all cases except Thalmann and SCE&G, for which the line was resagged to 120°F.
(b) Location has combined effects of Goshen (black), Goshen (white), and Augusta Newsprint, which run in parallel.
(c) Not applicable (na) because there are no public road crossings for the Wilson transmission line. It is entirely on GPC property.
(d) Calculation is for a 90-degree crossing – lesser angles could produce higher results.

Source: SNC 2007a

The Staff has reviewed the available information, including the applicant's evaluation and computational results, the site visit, the scoping process, and other public sources of information. Based on this information, the Staff evaluated the potential impacts of electric shock resulting from operation of VEGP and its associated transmission lines. It is the Staff's conclusion that the potential impacts of electric shock during the renewal term would be SMALL.

The staff identified a variety of measures that could mitigate potential acute EMF impacts resulting from continued operation of the VEPG transmission lines. These mitigation measures would include limiting public access to transmission line structures, installing road signs at road crossings, and increase transmission line clearances.

These mitigation measures could reduce human health impacts by minimizing public exposures to electric shock hazards. NESC rules as specified in Part 2, Rules 232C1c and 232D3c contain provisions that are considered necessary for the protection of employees and the public from acute EMF hazards associated with transmission lines, including during the license renewal period. SNC currently meets these rules. The staff did not identify any cost benefit studies applicable to the mitigation measures mentioned above.

4.2.2 Electromagnetic Fields-Chronic Effects

In the GEIS, the chronic effects of 60 hertz electromagnetic fields from power lines were not designated as Category 1 or 2, and a designation will not be made until a scientific consensus is reached on the health implications of these fields. The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy (DOE). The 1999 report of the NIEHS and DOE Working Group (Portier 1999) contains the following conclusion:

> The NIEHS concludes that extremely low frequency-electromagnetic field exposure (ELF-EMF) cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted, such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the Staff to change its position with respect to the chronic effects of electromagnetic fields. The Staff considers the GEIS finding of "not applicable" still appropriate and continues to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to VEGP in regard to radiological impacts are listed in Table 4-5. SNC stated in its Environmental Report (SNC 2007a) that it is not aware of any new and significant information associated with the renewal of the VEGP Operating License. The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there would be no impacts related to these issues beyond those discuss in the GEIS. For these issues, the Staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-6. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE- 10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
Human Health	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

A brief description of the Staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that:

Radiation doses to the public will continue at current levels associated with normal operations.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of radiation exposures to the public during the renewal term beyond those discuss in the GEIS.

Occupational exposures to public (license renewal term). Based on information in the GEIS, the Commission found that:

Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site audit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there would be no impacts of occupational exposures during the renewal term beyond those discuss in the GEIS.

There are no Category 2 issues related to radiological impacts of routine operations.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Term

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B–1, which are applicable to socioeconomic impacts during the renewal term are listed in Table 4–7. As stated in the GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and plant-specific mitigation measures would not be sufficiently beneficial to be warranted.

The Staff reviewed and evaluated the VEGP Environmental Report, scoping comments, other available information, and visited the VEGP site in search of new and significant information that would change the conclusions presented in the GEIS. No new and significant information was identified during this review. Therefore, it is expected that there would be no impacts related to these Category 1 issues during the renewal term beyond those discussed in the GEIS.

Table 4-7. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

The results of the review and brief statement of GEIS conclusions, as codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, for each of the socioeconomic Category 1 issues are provided below.

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that:

  Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

  No new and significant information was identified during the review. Therefore, it is expected that there would be no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that:

  Only impacts of small significance are expected.

  No new and significant information was identified during the review. Therefore, it is expected that there would be no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that:

  No significant impacts are expected during the license renewal term.

  No new and significant information was identified during the review. Therefore, it is expected that there would be no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that:

  No significant impacts are expected during the license renewal term.

  No new and significant information was identified during the review. Therefore, it is expected that there would be no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4–8 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and an additional issue, environmental justice, which was not addressed in the GEIS.

4.4.1 Housing Impacts

Appendix C of the GEIS presents a population characterization method based on two factors, sparseness and proximity (GEIS, Section C.1.4). Sparseness measures population density within 20 miles of the site, and proximity measures population density and city size within 50 miles. Each factor has categories of density and size (GEIS, Table C.1). A matrix is used to rank the population category as low, medium, or high (GEIS, Figure C.1).

Table 4–8. Category 2 Issues Applicable to Socioeconomics and Environmental Justice During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	SOCIOECONOMICS		
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Off-site land use (license renewal term)	4.7.4	I	4.4.3
Public services: transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental justice	Not addressed[a]	Not addressed[a]	4.4.6

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in plant-specific reviews.

According to the 2000 Census, approximately 43,857 people lived within 20 mi of VEGP, which equates to a population density of 46 persons per square mile (SNC 2007a). This density translates to sparseness Category 2 (40 to 60 persons per square mile and no community with 25,000 or more persons within 20 mi). Approximately 670,000 people live within 50 mi of VEGP (SNC 2007a). This equates to a population density of 89 persons per square mile. Applying the GEIS proximity measures, VEGP is classified as proximity Category 3 (one or more cities with 100,000 or more persons and less than 190 persons per sq mi within 50 mi). Therefore, according to the sparseness and proximity matrix presented in the GEIS, the VEGP ranks of sparseness Category 2 and proximity Category 3 result in the conclusion that VEGP is located in a medium population area.

Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, states that impacts on housing availability are expected to be of small significance in medium or high-density population areas where growth-control measures are not in effect. Since VEGP is located in a medium population area and Burke, Columbia, and Richmond Counties are not subject to growth-control measures that would limit housing development, any VEGP employment-related impact on housing availability would likely be small. Since SNC has indicated that there would be no major plant refurbishment and no non-outage employees would be added to support VEGP operations during the license renewal term, employment levels at VEGP would remain relatively constant with no additional demand for housing during the license renewal term. In addition, the number of available housing units has kept pace with or exceeded the low growth in the area population.

Based on this information, there would be no impacts on housing during the license renewal term.

4.4.2 Public Services: Public Utility Impacts

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to demand and thus there is no need to add capital facilities. Impacts are considered MODERATE if service capabilities are overtaxed during periods of peak demand. Impacts are considered LARGE if services (e.g., water, sewer) are substantially degraded and additional capacity is needed to meet ongoing demand. The GEIS indicated that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies.

Analysis of impacts on the public water systems considered both facility demand and facility-related population growth. As previously discussed in Section 2.2.2, VEGP obtains its potable water supply directly from groundwater sources. The facility does not purchase water from a public water system. Water usage by VEGP has not stressed the supply source capacity and is not currently an issue. SNC also has no plans to increase Unit 1 and Unit 2 staffing due to refurbishment or new construction activities, and has identified no operational changes during the license renewal term that would increase facility water use.

VEGP operations during the license renewal term would not increase facility-related population demand for public water services. Given that SNC has indicated that there would be no major plant refurbishment, overall employment levels at Unit 1 and Unit 2 would remain relatively constant during this period with no additional demand for public services. In addition, public water systems in the region would be adequate to provide the capacity required to meet the demand of residential and industrial customers in the area. Based on a review of available public water supply use and capacity information in the region, there would be no impact to public water services during the license renewal term.

4.4.3 Off-site Land Use During Operations

Off-site land use during the license renewal term is a Category 2 issue. Table B-1 of 10 CFR 51 Subpart A, Appendix B notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

SMALL - Little new development and minimal changes to an area's land-use pattern.

MODERATE - Considerable new development and some changes to the land-use pattern.

LARGE - Large-scale new development and major changes in the land-use pattern.

Tax revenue can affect land use because it enables local jurisdictions to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be MODERATE. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development.

Population-Related Impacts

Since SNC has no plans to add non-outage employees to Units 1 and 2 during the license renewal period, there would be no noticeable change in land use conditions in the vicinity of the VEGP site. Therefore, there would be no land use impacts during the license renewal term.

Tax-Revenue-Related Impacts

As previously discussed in Section 2.2.8.6.3, SNC and the VEGP site's co-owners pay annual real estate taxes to Burke County. From 2000 through 2007, the owners paid between $23.7 and $25.3 million annually in property taxes to Burke County. This represented between 74 and 82 percent of the county's total annual tax revenue. Each year, Burke County retains a portion of this tax money for county operations and disburses the remainder to the state, the school district, and fire/emergency management/public safety services to fund their respective operating budgets. The local public school system, Burke County School District, receives approximately 60 percent of the total county property tax revenue.

At present, the State of Georgia has taken no action on deregulation, which could, if enacted, affect tax payments to Burke County. However, any changes to VEGP property tax rates due to deregulation would be independent of license renewal. Discontinuing the current level of tax revenues would have a significant negative economic impact on the county.

SNC has indicated that there would be no major plant refurbishment or license renewal-related construction activities necessary to support the continued operation of Unit 1 and Unit 2 during the license renewal period. Accordingly, there would be no increase in the assessed value of VEGP and annual property taxes to Burke County would remain relatively constant throughout the license renewal period. Based on this information, there would be no tax revenue-related land-use impacts during the license-renewal term.

4.4.4 Public Services: Transportation Impacts During Operations

Table B-1, 10 CFR Part 51 states: "Transportation impacts (level of service) of highway traffic generated... during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites." All applicants are required by 10 CFR 51.53(c)(3)(ii)(J) to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license.

Given that VEGP has no plans to add non-outage employees to Units 1 or 2 during the license renewal period, there would be no noticeable change in traffic volume and levels of service on roadways in the vicinity of the VEGP site. Therefore, there would be no transportation impacts during the license renewal term.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) requires that Federal agencies take in to account the effects of their undertakings on historic properties. The historic preservation review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation at 36 CFR Part 800. Renewal of an operating license is an undertaking that could potentially affect historic properties. Therefore, according to the NHPA, the NRC is to make a reasonable effort to identify historic properties in areas of potential effects. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Officer before proceeding. If it is determined that historic properties are present the NRC is required to assess and resolve possible adverse effects of the undertaking.

4.4.5.1 Site Specific Cultural Resources Information

A review of the Georgia State Historic Preservation Office (SHPO) files shows that there are no National Register listed archaeological or above ground historic resources identified on the

VEGP property. As noted in Section 2.2.9.2, three surveys, conducted in 2005, 2006 and 2007, of specific portions of the VEGP site resulted in the identification of 17 archaeological sites, two of which were eventually determined to be eligible for listing on the Nation Register of Historic Places (NSA 2006a and 2006b).

There is potential for archaeological resources to be present on other portions of the VEGP site that have not been surveyed. As noted in Section 2.2.9.2, while seven National Register listed resources have been identified in Burke County, none are located within the boundaries of the VEGP.

4.4.5.2 Conclusions

The staff does not expect any significant impacts on historic and archaeological resources during the license renewal term. Any new ground-disturbing activities that might occur during plant operations would follow SNC's procedures, which would require further evaluation to determine if additional archaeological review is necessary. Therefore, the staff concludes that the impacts from operations would be SMALL. Some mitigation might be required in the event of an unexpected discovery.

4.4.6 Environmental Justice

Executive Order (EO) 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. In 2004, the Commission issued a *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (69 FR 52040) which states "The Commission is committed to the general goals set forth in EO 12898, and strives to meet those goals as part of its NEPA review process."

The Council of Environmental Quality (CEQ) provides the following information in *Environmental Justice: Guidance Under the National Environmental Policy Act* (CEQ 1997):

- Disproportionately High and Adverse Human Health Effects. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by the National Environmental Policy Act [NEPA]) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group (CEQ 1997).

- Disproportionately High and Adverse Environmental Effects. A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered (CEQ 1997).

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the operation of VEGP during the renewal term. In assessing the impacts, the following CEQ (CEQ 1997) definitions of minority individuals and populations and low-income population were used:

- Minority individuals. Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races, meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

- Minority populations. Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

- Low-income populations. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P-60, on Income and Poverty.

4.4.6.1 Minority Populations in 2000

Data from the U.S. Census Bureau's (USCB) 2000 census for Georgia identifies 28.7 percent of the state population as Black or African American; 0.3 percent American Indian or Alaskan Native; 2.1 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 2.4 percent some other race; 1.4 percent two or more races; 34.9 percent aggregate of minority races; and 5.3 percent Hispanic or Latino ethnicity (USCB 2000a). For South Carolina, the USCB reports 29.5 percent of the state population as Black or African American; 0.3 percent American Indian or Alaskan Native; 0.9 percent Asian; 0.04 percent Native Hawaiian or other Pacific Islander; 1.0

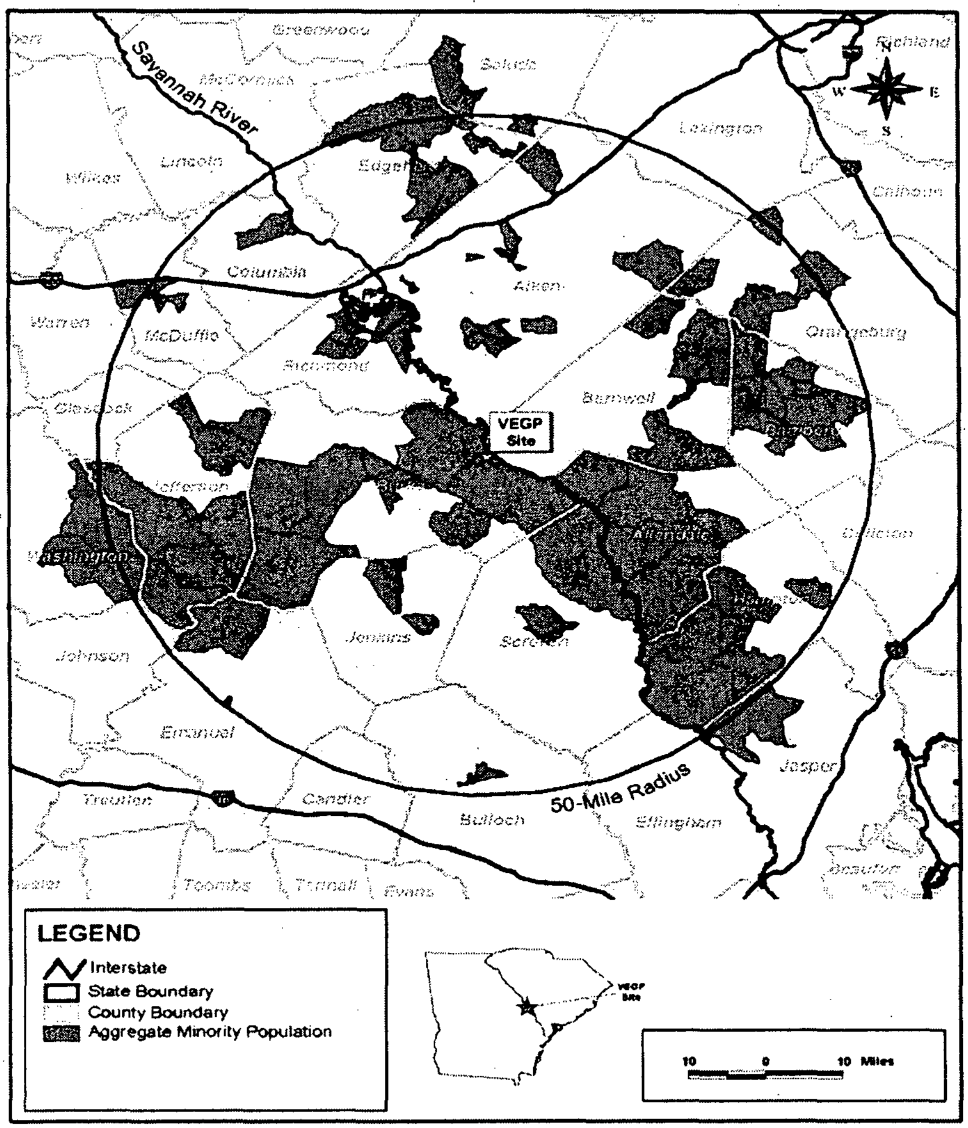
percent some other race; 1.0 percent two or more races; 32.8 percent aggregate of minority races; and 2.4 percent Hispanic or Latino ethnicity (USCB 2000a).

Those census block groups (491) wholly or partly within the 50-mi radius of VEGP were reported in the 2000 census as having a minority population of 275,179 or 42.0 percent of the total population in these block groups. Of those 491 block groups, 168 were reported in the 2000 census as having aggregate minority population percentages that exceed the state average by 20 percentage points or more, while 183 census block groups have aggregate minority population percentages that exceed 50 percent. The largest minority group was Black or African American, with 175 block groups that exceed the state average by 20 percent or more and 171 that have Black or African American populations of 50 percent or more. These block groups are located in ten Georgia counties and nine counties in South Carolina. One census block group (in Aiken County, South Carolina) exceeded the state average for Hispanic or Latino ethnicity by 20 percent or more, but no block groups had 50 percent or more. No other minority classifications exceeded either the 20 percent or 50 percent selection criterion (NRC 2007).

Based on 2000 census data, Figure 4-1 shows the block groups with high density minority populations within a 50-mi radius of VEGP.

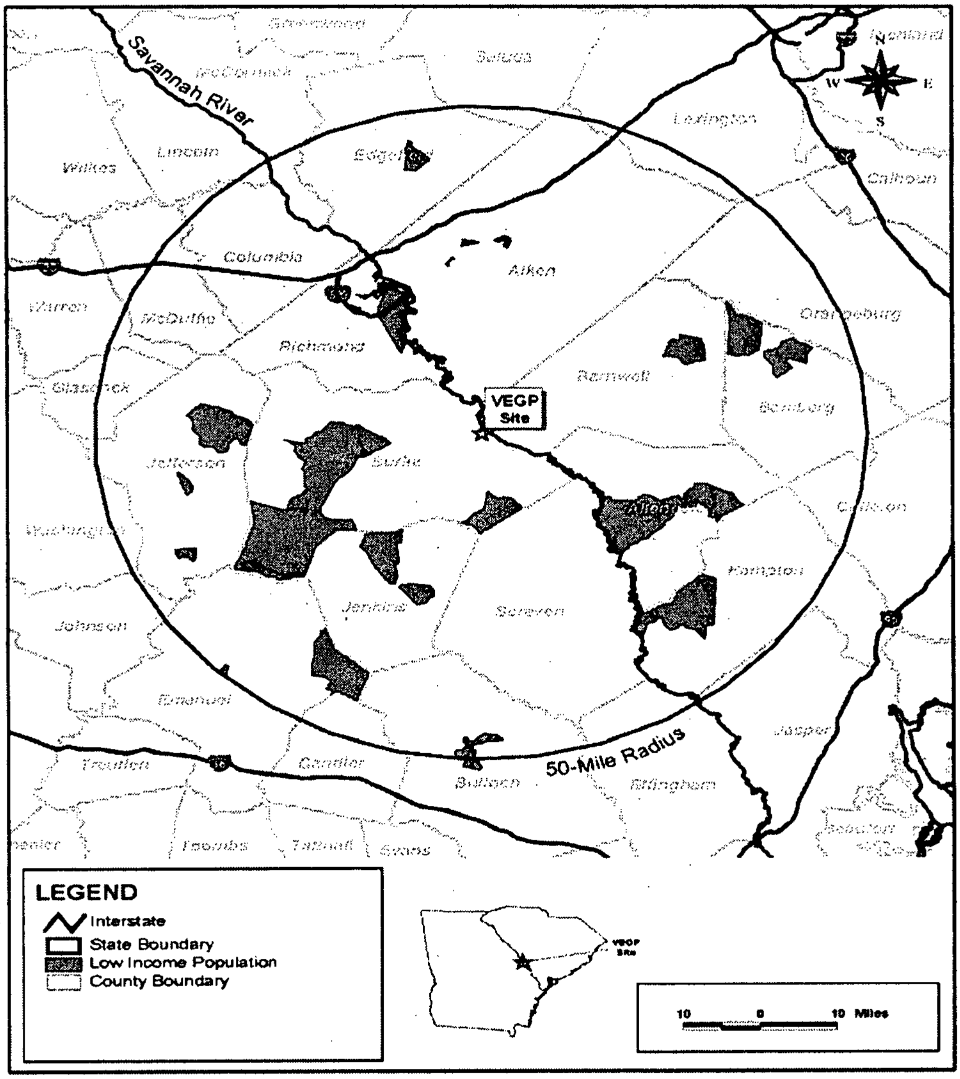
4.4.6.2 Low-Income Populations in 2000

According to 2000 census data, 12.6 percent of Georgia households and 14.1 percent of South Carolina households were identified as living below the Federal poverty threshold (USCB 2000b). (The 1999 Federal poverty threshold was $17,029 for a family of four.) A total of 108,732 individuals (17.1 percent) and 23,580 families (13.6 percent) residing in the census blocks within a 50-mi radius of VEGP were identified as living below the Federal poverty threshold. Census block groups were considered high density low-income block groups if the percentage of the population living below the Federal poverty threshold exceeded the state average by 20 percent or more, or if 50 percent or more of the households in the block group exceeded the state average. Based on 2000 Census data, there were 72 block groups within a 50-mi radius of VEGP that exceeded the state average for low income households by 20 percent or more. Of those 72 block groups, 14 had 50 percent or more low-income households (NRC 2007). Figure 4-2 shows low-income census block groups within a 50-mi radius of VEGP.



Source: SNC 2007a

Figure 4-1. Minority block groups in 2000 within a 50-mi radius of VEGP



Source: SNC 2007a

Figure 4-2. Low-income block groups in 2000 within a 50-mi radius of VEGP

4.4.6.3 Analysis of Impacts

Based on the analysis of impacts for all resource areas presented in this draft SEIS, it was determined that there would be no significant adverse health impacts on members of the public and, therefore, there would be no disproportionate and adverse impacts felt by minority or low-income populations within the region of interest. Similarly, given that the potential environmental effects of continued operation on the physical environment (water, air, aquatic and terrestrial resources) and socioeconomic conditions, there would be no disproportionately high and adverse impacts on minority and low-income populations because of negative environmental effects.

NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish and wildlife. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

4.4.6.4 Subsistence Consumption of Fish and Wildlife

Section 4-4 of EO 12898 (59 FR 7629) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who rely principally on fish and/or wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In this draft SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors.

Fish advisories issued by the States of Georgia and South Carolina for the Savannah River have indicated that some species, especially predatory species, can carry levels of radioactive contamination that could be harmful if ingested. However, an in-depth evaluation by the Institute for Energy and Environmental Research found that VEGP is responsible for only a small amount of the radiological contamination (principally tritium) in the Savannah River and its organisms (NRC 2007).

SNC has a comprehensive Radiological Environmental Monitoring Plan (REMP) at VEGP to assess the impact of site operations on the environment. Samples are collected from the aquatic and terrestrial pathways applicable to the site. The aquatic pathways include fish, surface waters and sediment. The terrestrial pathways include airborne particulates and radioiodine, milk, fish, grass or leafy vegetation, and direct radiation.

No man-made radionuclides were detected in fish samples in 2006. In 2006, several outages resulted in an increase of the annual curies of tritium released in liquid effluents from the site. The increase in liquid effluents along with drought conditions on the river contributed to a higher annual tritium average. Although the drinking water stations are much further downstream, the potential dose to someone consuming water near the plant discharge for an entire year (730 liters) would be 1.47×10^{-2} millirems (mrem) in a year. The potential dose from tritium in the river to an individual who regularly consumed fish in the vicinity of the plant would be 3.82×10^{-3} mrem in a year. The dose limit to a member of the public due to liquid effluents is 3 mrem per year (SNC 2007d).

During 2006, analyses were performed on collected samples of environmental media as part of the required REMP and showed no discernible radiological impact from VEGP operations, except for two instances. Cesium-137 and cobalt-60 were found in indicator samples of river sediment. Cesium-137 activity was also detected in control samples, but at lower concentrations than the indicator samples. The presence of cesium-137 in these samples could be attributed to VEGP effluents, the Savannah River Site (SRS), or from fallout from past weapons testing and from the Chernobyl incident. The cobalt-60 activity could be attributable to releases from either SRS or VEGP because it was not detected in the control samples. The associated total body dose in a year to a member of the public expected to receive the highest dose was less than 0.1 percent of the Offsite Dose Calculation Manual annual limit for an operating unit. In summary, the results of the 2006 REMP demonstrate that the routine operation at the VEGP site had no adverse radiological impact on the environment or to the public (SNC 2007d).

Georgia Environmental Protection Division (GEPD) also conducts its own environmental radiation surveillance program of VEGP, which parallels (and partially overlaps) the SNC REMP. The purpose of the surveillance program, instituted in 1976, is to detect, identify, and measure radioactive material released to the environment from the operation of nine facilities in or bordering Georgia. The most extensive monitoring network is focused on an area in Georgia adjacent to and downstream of SRS and VEGP. Similar to REMP, air, surface and ground water, rain, milk, sediment and soil, fish, game animals, crops and vegetation samples are collected by GEPD from the environs surrounding VEGP and SRS. Analyses of environmental samples are performed at the Environmental Radiation Laboratory at Georgia Tech. Georgia Department of Natural Resources has provided deer from five zones in east central Georgia, along the Savannah River. GEPD staff collects several species of sport fish from the Savannah River near VEGP and SRS (GEPD 2004).

The GEPD found elevated concentrations of cesium-137 and tritium in fish samples taken near VEGP. GEPD attributed less than 10 percent of the tritium to VEGP; the majority was attributed to SRS. Similarly, the cesiuim-137 levels were attributed to SRS. All fish samples, except one collected near SRS, were below any significant risk level-of-concern. Cesium-137 and tritium were the only man-made radionuclides detected in deer, from samples collected adjacent to SRS and they were considered most likely due to SRS releases. GEPD determined that consumption of deer near SRS would be unlikely to pose a significant long-term radiological risk. Based on these monitoring results, concentrations of VEGP-related contaminants in fish and game animals in areas surrounding VEGP have been quite low (GEPD 2004).

Consequently, no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

4.5 Groundwater Use and Quality

There are no Category 1 issues related to groundwater use and quality in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to VEGP operations. The Category 2 issues related to groundwater use and quality during the renewal term that are applicable to VEGP are discussed in the sections that follow, and are listed in Table 4-9.

Table 4-9. Category 2 Issues Applicable to VEGP Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	Draft SEIS Section
GROUNDWATER USE AND QUALITY			
Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gallons per minute [gpm])	4.8.1.1	C	4.5.1
Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	4.8.1.3	A	4.5.2

4.5.1 Groundwater Use Conflicts, Plants Using > 100 GPM

For plants that withdraw groundwater to supply potable and service water systems at a rate greater than 100 gpm, potential groundwater use conflicts are considered a Category 2 issue, thus requiring a site-specific assessment for license renewal review. VEGP uses an annual average of approximately 1.05 mgd, equivalent to a rate of 729 gpm. Therefore, groundwater use conflicts are a potentially applicable issue for relicensing of VEGP. The GEIS considered groundwater water use conflicts to be a Category 2 issue because of the potential for withdrawal of groundwater to reduce the volume of groundwater available to other users in the area. The Staff independently reviewed the VEGP Environmental Report, visited the site, and consulted with Federal and State resource agencies to evaluate the potential for this withdrawal to impact the availability of groundwater within the region surrounding VEGP.

4.5.1.1 Groundwater Users Potentially Impacted

The aquifers located at VEGP are used as a source of water supply for several other groundwater users within the local area. Uses of groundwater within the local area include municipal water supplies, as well as industrial, domestic, and agricultural uses (SNC 2007a). A summary of the local municipalities and industries within Burke County which use groundwater for water supply is provided in Table 4-10.

Table 4-10. Permitted Municipal and Industrial Groundwater Users in Burke County

Permit User Name	Number of Wells	Permitted Withdrawal		Permitted Aquifer
		Monthly Average (mgd)	Annual Average (mgd)	
City of Waynesboro	4	4	3.5	Cretaceous Sand
Southern Nuclear Operating Co – Plant Vogtle	8	6	5.5	Cretaceous Sand
International Paper	2	0.95	0.95	Cretaceous Sand
City of Sardis	2	0.4	0.4	Cretaceous Sand

Source: GDNR 2007b

Other municipal and industrial groundwater users that may be impacted include the towns of Girard and Sylvania, and the Augusta-Richmond Utilities Department (SNC 2007a, GDNR 2007b). The nearest permitted agricultural supply well is located 3.4 mi northwest of VEGP, and the nearest supply well listed in the Safe Drinking Water Information System (SDWIS) is located 4.9 mi to the southwest. Both of these wells produce water from the Tertiary Aquifer (SNC 2006b). The nearest permitted industrial supply well is the International Paper well, which is 8.5 mi to the northwest of VEGP (SNC 2006b). The nearest municipal supply well is the City of Waynesboro system, located 14.5 mi to the southwest (SNC 2006b). Although the nearest reported domestic well is located across River Road from the facility (SNC 2006b), most groundwater use for domestic purposes in eastern Burke County is from private domestic wells that produce less than 10 gpm (SNC 2007a).

4.5.1.2 Effect of Withdrawal on Groundwater Volume Available

As discussed in Section 2.2.3, the facility withdraws groundwater through a total of nine groundwater supply wells. These wells have a permitted capacity of 5.5 mgd, while the actual annual average withdrawal volume since 2000 is 1.05 mgd (SNC 2007a).

To evaluate the potential impact of groundwater withdrawal, the applicant performed modeling to calculate the potential drawdown. The calculation was performed using the following assumptions:

- Average withdrawal rate of 1.05 mgd;
- The entire 1.05 mgd is withdrawn from well MU-2A, which is the well closest to the VEGP property boundary (5,700 ft) and to an offsite production well; and
- The Cretaceous and Tertiary aquifers are hydraulically connected in a "leaky" aquifer scenario.

The result of this calculation was that the drawdown in the aquifer at the closest property boundary, in the direction of the nearest offsite well, was 1.9 ft after production of 10 years, and remained constant at 1.9 ft through the end of the license renewal term. Because the drawdown is relatively small and constant, the applicant concluded that the impact of VEGP groundwater withdrawals on groundwater resources would be SMALL (SNC 2007a). Similar calculations performed to evaluate the impact of groundwater withdrawal for the potential expansion of the facility, using the same withdrawal rate just for Units 1 and 2, also concluded that the maximum drawdown at 5,700 ft would be 1.9 ft (NRC 2007).

To evaluate these estimates, the Staff reviewed the assumptions and performed independent calculations of the groundwater drawdown. The Staff verified the assumptions used for the calculations were conservative, which results in developing a worst-case estimate of the potential impacts to groundwater resources. The independent calculations verified the expected amount of drawdown in the aquifer is limited, and therefore the expected impacts to groundwater resources are SMALL.

4.5.1.3 Summary of Impacts Related to Groundwater Use Conflicts

The Staff has reviewed the potential effect of water withdrawals on the availability of groundwater in the local area near the facility. Based on a review of the available information relative to potential impacts of the use of cooling and service water on the availability of groundwater in the local area, the Staff concludes that the potential impacts from renewal of the operating license would be SMALL.

The staff identified a variety of measures that could mitigate potential groundwater use impacts resulting from continued operation of the VEGP groundwater withdrawal wells. Potential mitigation measures for the effects of the impact of groundwater use on groundwater resources could include reduction in the ground water withdrawal rates or the possible recycling and treatment of gray water to supplement potable water supplies.

The staff did not identify any cost benefit studies applicable to these mitigation measures. The volume of groundwater withdrawal use for the facility is authorized under a Groundwater Use Permit issued by the GEPD, and NRC expects that analysis of the costs and benefits of any mitigation measures would be evaluated by GEPD as part of that permitting program.

4.5.2 Groundwater Use Conflicts, Plants Using Cooling Towers Withdrawing Make-Up Water from Small River

For plants with cooling tower systems that are supplied with make-up water from a small river with low flow, potential groundwater use conflicts are considered a Category 2 issue, thus requiring a site-specific assessment for license renewal review. Since 1953 (the year of the opening of the J. Strom Thurmond Dam), the mean annual flow volume of the Savannah River at Augusta (22 mi upstream from VEGP) has ranged from 4,470 to 16,580 cfs (USGS 2007a). This volume meets the NRC definition of a small river of 100,000 cfs (3.15 X 10^{12} ft^3/yr listed in 10 CFR Part 51.53(c)(3)(ii)(A)), resulting in water use conflicts being a potentially applicable issue for relicensing of VEGP. VEGP withdraws water from the Savannah River to provide make-up water to the cooling tower system. Therefore, groundwater use conflicts are a potentially applicable issue for relicensing of VEGP.

The GEIS considered groundwater water use conflicts to be a Category 2 issue because of the potential for withdrawal of surface water to lower the volume of groundwater in the aquifers associated with the river, thus reducing the volume of groundwater available to other users in the area. The Staff independently reviewed the VEGP Environmental Report, visited the site, and consulted with Federal and State resource agencies to evaluate the potential for the facility's surface water withdrawals to impact the availability of groundwater within the aquifer system associated with the Savannah River.

As discussed in Section 4.5.1, the use of groundwater in the immediate vicinity of VEGP is confined to small domestic users. These wells, as well as the industrial and municipal groundwater users in the area, withdraw water from the Cretaceous, Tertiary, and Water Table aquifers. There is no reported use of groundwater from the alluvial aquifer located along the Savannah River, which is the only aquifer that could be impacted by water withdrawal from the river (SNC 2007a).

In Section 4.1.1 the Staff calculated that VEGP's consumptive water withdrawals from the Savannah River would constitute, at most, about 2 percent of the flow volume of the Savannah River during a severe drought period. This withdrawal rate would not significantly reduce the water level in the Savannah River and would not affect recharge from the river into the aquifer system.

Based on a review of the available information relative to potential impacts on groundwater resources from surface water withdrawals, the Staff concludes that the potential impacts from renewal of the operating license would be SMALL.

The staff identified a variety of measures that could mitigate potential groundwater impacts resulting from continued operation of VEGP cooling water system. Potential mitigation measures for the effects of the cooling water system on groundwater resources include reduction in the use of river water, or additional recycling of cooling water. These mitigation measures could reduce groundwater resource impacts by reducing the consumptive use of water within the Savannah River.

The staff did not identify any cost benefit studies applicable to these mitigation measures. The volume of consumptive water use for the facility is authorized under a Permit to Withdraw, Divert, or Impound Surface Water issued by the GEPD, and NRC expects that analysis of the costs and benefits of any mitigation measures would be evaluated by GEPD as part of that permitting program.

4.6 Threatened or Endangered Species

Potential impacts to threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-11.

Table 4-11. Category 2 Issues Applicable to Threatened or Endangered Species During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	Draft SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or Endangered Species	4.1	E	4.6

This issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of the nuclear facility during the license renewal term. The presence of threatened or endangered species in the vicinity of the VEGP site is discussed in Sections 2.2.5.4 and 2.2.6.4. On August 22, 2007, the Staff contacted the National Marine Fisheries Services (NMFS) and FWS and to request information on threatened and endangered species and the impacts of license renewal (NRC 2007). In its response, the NMFS provided a list of Federally protected species under its jurisdiction for the State of Georgia (NMFS 2007).

Although the NRC staff does not believe that license renewal would adversely affect the Federally listed species, the Staff has prepared a Biological Assessment (BA) for NMFS that documents its review. The BA is provided in Appendix E of this draft SEIS.

4.6.1 Aquatic Threatened or Endangered Species

Of the Federally listed aquatic species mentioned in Section 2.2.5.4.1, the occurrence of one species, the shortnose sturgeon (*Acipenser brevirostrum)*, has been confirmed in the area of the site. The shortnose sturgeon occurs in the Savannah River both upstream and downstream of the VEGP site. There is no designated critical habitat in the vicinity of the VEGP site for the shortnose sturgeon or other Federally listed threatened or endangered species.

Of the rare aquatic species recorded as occurring in the 18 counties crossed by the 360 mi of transmission line ROWs, Section 2.2.5.4.2 identified five aquatic species that potentially may occur in the ROWs: the endangered shortnose sturgeon and West Indian manatee (*Trichecus manatus*) and three Federally listed plant species, the threatened pool sprite (*Amphianthus pusillus*), and the endangered mat-forming quillwort (*Isoetes tegetiformans*) and harperella (*Ptilimnium nodosum*). In addition, one Federal candidate species, the Altamaha spinymussel (*Elliptio spinosa*), was identified as having recorded occurrences in two of the counties. As described in Section 2.2.5.4.2, none of these species is known to or likely to occur within the ROWs. Given that no change in operations, expansion of existing facilities, or disturbance of additional land is anticipated in conjunction with the transmission lines, these Federally listed aquatic species would not be adversely affected by the transmission line ROWs during the renewal period.

The shortnose sturgeon is the only Federally listed aquatic species with the potential to be adversely affected by continued operation of VEGP during the renewal period. The staff has prepared a Biological Assessment for NMFS under Section 7 of the Endangered Species Act, evaluating the potential impacts on shortnose sturgeon related to 1) entrainment and impingement at the VEGP intake structure, and 2) thermal and chemical discharges.

As described in Section 2.2.5.4, shortnose sturgeon are known to occur in the Savannah River in the vicinity of the site. There are two probable spawning sites, one 32 RM downstream of the VEGP intake and the other 18 RM upstream of the intake. Because the fertilized eggs of shortnose sturgeon are demersal and adhere to hard substrates on the river bottom, they are less likely to be entrained into the cooling water system than eggs of other species. Shortnose sturgeon larvae seek out shelter on the river bottom, and are similarly unlikely to be entrained by the VEGP cooling system. As explained in Section 4.1, the continued operation of VEGP would have no impact on the entrainment of fish in early life stages; this conclusion is also applicable to the shortnose sturgeon.

The design and operation of VEGP Units 1 and 2 intake structures results in velocities across the traveling screens of 0.7 feet per second (fps) (0.2 meters per second [m/s]) which is slow enough to allow adult shortnose sturgeon to swim away from the intake without becoming impinged, especially considering their adaptation to swimming in a riverine habitat with strong currents. This is consistent with the conclusion in Section 4.1 that the continued operation of VEGP would have no impact on the impingement of fish.

The VEGP cooling water system discharges blowdown into the Savannah River downriver of the intake structure. The NRC staff conducted an assessment of the existing thermal plume from Units 1 and 2 (NRC 2007) that shows the area affected by the thermal discharge is small compared to the width of the Savannah River. Therefore, the thermal plume from the existing discharge does not impede the passage of shortnose sturgeon in the vicinity of VEGP site and would have no impact on the species. In addition, the discharge of chemicals into the Savannah River are low in concentration and are further diluted by the river, so that they would not affect the shortnose sturgeon (NRC 2007).

Continued operation of VEGP Units 1 and 2 during the renewal period is not likely to adversely affect the shortnose sturgeon and therefore the impacts to the shortnose sturgeon would be SMALL.

The staff identified a variety of measures that could mitigate potential impacts resulting from continued operation of VEGP cooling water system. A few mitigation measures for the potential effects of the cooling water system on the shortnose sturgeon include: installation of a fish return system, derating the facility, and scheduling plant outages during the spawning season. These mitigation measures could reduce impacts by increasing survival of any impinged fish and limiting the amount of water taken in by the cooling system, thereby reducing the likelihood of impingement and entrainment of shortnose sturgeon.

The staff did not identify any cost benefit studies applicable to these mitigation measures. If, as part of the ongoing ESA Section 7 consultation, NMFS develops a Biological Opinion for the shortnose sturgeon, and if NMFS were to determine that there are reasonable and prudent measures to minimize the impact of the VEGP cooling system on the shortnose sturgeon, these measures would be explained in the terms and conditions of the Biological Opinion.

4.6.2 Terrestrial Threatened or Endangered Species

As discussed in Section 2.2.6.2, there are seven Federally listed terrestrial species that have the potential to occur at or near the VEGP site or within the associated transmission line ROWs: the smooth coneflower (*Echinacea laevigata*), Canby's dropwort (*Oxypolis canbyi*), relict trillium (*Trillium reliquum*), wood stork (*Mycteria americana*), red-cockaded woodpecker (*Picoides* *borealis*), American alligator (*Alligator mississippiensis*), and flatwoods salamander (*Ambystoma cingulatum*).

The American alligator is the only such species to be found regularly on the VEGP site; however, it is not rare itself but has a listing status of "threatened due to similarity of appearance" in order to protect the endangered American crocodile (*Crocodylus acutus*). There is no known historical documentation of smooth coneflower or relict trillium on the VEGP site or in the associated transmission line ROWs, and suitable habitat for the species on the VEGP site is unlikely (NRC 2007; TRC 2006). There have been no historical occurrences of Canby's dropwort recorded within 10 mi (16 km) of the site, and suitable habitat for the species on the VEGP site is unlikely (TRC 2006). Suitable habitat for the flatwoods salamander may exist on the site, but there have been no historical occurrences of the species recorded in the vicinity. Habitat capable of supporting the flatwoods salamander could be present within the West McIntosh (Thalmann) ROW. The flatwoods salamander would not be adversely affected by ongoing maintenance of the ROW or by future operations. There is no recorded occurrences of red-cockaded woodpecker on or in the vicinity of the VEGP site or associated transmission line ROWs, however, potential suitable habitat does exist. The woodpecker is unlikely to be affected by future operation of the VEGP site. Wood stork individuals have been seen within 2 mi (3.2 km) of the VEGP site; however, the closest colony is 28 mi (45 km) away. Additionally, the stork was observed at two locations on the Scherer transmission line ROW (TRC 2006). The wood stork, in particular, is highly mobile and potentially could forage in wetlands on the site. Impacts to the wood stork from operation of the VEGP site would be negligible.

The NRC Staff reviewed information from the site audit, VEGP's Environmental Report, other reports, and information from FWS. The Staff concludes that the impacts on Federally listed threatened or endangered species of an additional 20 years of operation and maintenance of the VEGP site and associated transmission line ROWs would be SMALL.

4.7 Evaluation of New and Potentially Significant Information on Impacts of Operations During the Renewal Term

The Staff has not identified new and significant information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation during the renewal term. The Staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment. The Staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and has conducted its own independent review, including public scoping meetings, to identify issues with new and significant information. Processes for identification and evaluation of new information are described in Section 1.2.2.

4.8 Cumulative Impacts

The NRC Staff considered potential cumulative impacts on the environment resulting from the incremental impact of license renewal when added to other past, present, and reasonably foreseeable future actions. For the purposes of this analysis, past actions are those related to the resources when VEGP was licensed and constructed, present actions are related to the resources during current operations, and future actions are those that are reasonably foreseeable through the end of station operations, including the license renewal term. The geographical area over which past, present, and future actions are assessed is dependent on the affected resource.

The impacts of the proposed action, license renewal, as described in previous sections of Chapter 4, are combined with other past, present, and reasonably foreseeable future actions in the potentially affected area regardless of which agency (Federal or non-Federal) or entity is undertaking the actions. The combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time (CEQ 1997). It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

The NRC staff has identified the principal past, present, and reasonably foreseeable future actions potentially impacting the environment affected by VEGP. These include: the proposed VEGP Units 3 and 4 (future); major SRS facilities, including nuclear reactors (past), the D-Area powerhouse (present), and the Mixed Oxide (MOX) Fuel Fabrication Facility (future); and other users of Savannah River water. VEGP Units 3 and 4 would be located adjacent to Units 1 and 2 and would have similar environmental impacts from operation (NRC 2007).

The principal SRS facilities with a potential to affect the Savannah River due to their water withdrawals and discharges historically were the five production reactors (the C, K, L, P, and R reactors), a coal-fired power plant (the D-Area powerhouse), and a heavy water production facility. During their initial operation, all of these facilities used once-through cooling systems in which water was pumped from the Savannah River, used in secondary cooling, and discharged into the nearest surface stream, which returned the effluent to the river. Numerous changes involving the cooling water systems subsequently occurred, including the construction of two cooling ponds and the shutdowns of the reactors. Use of Savannah River surface water by SRS varied, with estimated withdrawal rates ranging from 8.5 cms to 26.0 cms, depending on the number of reactors in operation and the power levels at which they were operating. Generally, the amount of water withdrawn by SRS was approximately 9 percent of the average annual flow in the Savannah River (DuPont 1987). The heavy water production facility was placed on standby in 1982 (DuPont 1987), and all five nuclear reactors were shut down and placed on standby prior to 1989 (Reed et al. 2002). Of these SRS facilities, only the D-Area powerhouse is currently operational.

The D-Area powerhouse is a coal-fired power plant that has been in operation since 1952 (DOE 1995). In October 1995, the SRS power generation and production facilities were privatized and transferred to South Carolina Electric & Gas (SCE&G). Condenser cooling water for the powerhouse is withdrawn from the Savannah River through one of the SRS intakes located upstream of the VEGP site. Heated water from the condenser is discharged at the origin of Beaver Dam Creek, which flows south for approximately 3 miles and discharges into the Savannah River floodplain swamp, through which the water flows to the river (DOE 1995). The D-Area powerhouse currently is the only major SRS facility with the potential to contribute to cumulative impacts on the Savannah River in conjunction with the effects of continued operation of VEGP Units 1 and 2.

The MOX Fuel Fabrication Facility is currently under construction in the F-Area of SRS. Site preparation began in October 2005, and the facility is scheduled to be in operation by 2016. The 41-acre complex will convert an estimated total of 75,000 lbs of weapons-grade plutonium to nuclear reactor fuel during its 20-year licensing period (NRC 2005). No surface water from the Savannah River or other surface water sources will be used during the construction or operation of the MOX facility (groundwater will be used). Discharges from the component facility that will process liquid wastes will be discharged to the Savannah River through a NPDES-permitted outfall. Constituent concentrations in the river are estimated to remain within their current ranges, and impacts are expected to be small (NRC 2005). Thus, construction and future operation of the MOX facility at SRS would not contribute to cumulative impacts on the Savannah River in conjunction with the effects of continued operation of VEGP Units 1 and 2.

Users of Savannah River water other than VEGP and SRS are identified below.

4.8.1 Cumulative Impacts on Water Use and Quality

Cumulative water use impacts may occur with respect to the amount of water available for use from the Savannah River or from local groundwater resources. These impacts may occur if operations of VEGP and other facilities are resulting in consumptive water use from the Savannah River or from groundwater aquifers. Cumulative water quality impact issues in the area near VEGP include thermal stresses within the Savannah River, the release of contaminants to the river and to groundwater, saltwater intrusion within the groundwater aquifers, and the detection of tritium in the unconfined aquifer. The geographic scope of the surface water resources that may be impacted by VEGP include the stretch of the Savannah River from Augusta to Savannah, Georgia. Groundwater resource impacts may exist in the local area near the VEGP facility, and also include regional drawdown and contamination issues.

4.8.1.1 Water Use Impacts

The other known users of water from the Savannah River, and their permitted volumes of withdrawal, are provided in Table 4-12. A study of water use data near VEGP from 1980 to 2000 indicated that surface water and groundwater withdrawal rates remained constant (Fanning 2003). However, population growth is expected to increase use of the Savannah River as a water resource near Savannah, approximately 150 mi downstream of VEGP (NRC 2007).

Table 4-12. Current, Past, and Potential Future Water Withdrawal Permits within Savannah River Basin

Facility	Location	Maximum Daily Withdrawal (mgd)	Monthly Average Withdrawal (mgd)
Georgia			
Banks County Board of Commissioners	Banks County, GA	1.00	1.00
Southern Nuclear Operating Company (VEGP Units 1 and 2)	Burke County, GA RM 150-152	127.00	85.00
VEGP Units 3 and 4	Burke County, GA RM 151.2	127.00	85.00
City of Waynesboro	Burke County, GA	1.5	1.0
Weyerhaeuser Company	Chatham County, GA	30.50	27.50
Georgia Power Company Port Wentworth	Chatham County, GA	267.00	267.00
International Paper Corporation	Chatham County, GA	58.00	50.00
Kerr-McGee Chemical	Chatham County, GA	30.00	20.00
Columbia County Water System	Columbia County, GA	8.00	8.00
Columbia County Water System	Columbia County, GA	31.00	31.00
Fort James Operating Company	Effingham County, GA RM 44-46	35.00	35.00

Table 4-12. (cont'd)

Facility	Location	Maximum Daily Withdrawal (mgd)	Monthly Average Withdrawal (mgd)
Georgia Power Company Plant McIntosh	Effingham County, GA RM 44-46	130.00	130.00
Savannah Industrial and Domestic Water	Effingham County, GA	55.00	50.00
City of Elberton	Elbert County, GA	2.20	1.70
City of Elberton	Elbert County, GA	4.10	3.70
City of Lavonia	Franklin County, GA	1.50	1.50
City of Lavonia	Franklin County, GA	3.00	3.00
City of Royston	Franklin County, GA	1.00	1.00
City of Union Point	Greene County, GA	0.45	0.33
City of Hartwell	Hart County, GA	4.50	3.50
City of Commerce	Jackson County, GA	4.50	4.20
JM Huber - Ready Creek	Jefferson County, GA	5.80	4.00
City of Lincolnton	Lincoln County, GA	0.63	0.63
Turner Concrete Company	Madison County, GA	0.60	0.30
Thomson-McDuffie County W/S Commission	McDuffie County	3.00	2.00
Thomson-McDuffie County W/S Commission	McDuffie County	2.00	1.50
City of Crawford	Oglethorpe County, GA	0.43	0.25
Clayton-Rabun Co. Water & Sewer Authority	Rabun County, GA	2.00	2.00
Augusta-Richmond County	Richmond County, GA	50.00	45.00
Augusta-Richmond County	Richmond County, GA	21.00	15.00
Avondale Mills – Augusta Canal	Richmond County, GA	1.44	0.65
DSM Chemicals Augusta Inc.	Richmond County, GA	8.20	6.80
Fort Gordon – Butler Creek	Richmond County, GA	5.40	5.00

Table 4-12. (cont'd)

Facility	Location	Maximum Daily Withdrawal (mgd)	Monthly Average Withdrawal (mgd)
Fort Gordon – Cow Branch	Richmond County, GA	0.70	0.60
Fort Gordon – Lietner Lake	Richmond County, GA	0.50	0.40
Fort Gordon – Union Mill Pond	Richmond County, GA	0.25	0.20
General Chemical Corp. Augusta Plant	Richmond County, GA	5.65	5.30
International Paper Augusta Mill	Richmond County, GA	79.00	72.00
PCS Nitrogen Fertilizer, L.P.	Richmond County, GA	21.60	10.80
City of Toccoa	Stephens County, GA	6.00	6.00
City of Toccoa – Lake Toccoa	Stephens County, GA	9.00	9.00
JM Huber Corporation – Brier Creek	Warren County, GA	5.00	2.50
Thiele Kaolin Company	Warren County, GA	0.75	0.50
City of Washington – Clarks Hill	Wilkes County, GA	2.20	2.00
City of Washington – Old Plant	Wilkes County, GA	2.20	1.80
South Carolina			
City of Abbeville	Abbeville County, SC	10.6	-
Mohawk Industries	Abbeville County, SC	4.3	-
City of North Augusta	Aiken County, SC	25.8	-
Graniteville Co.	Aiken County, SC	2.0	-
SCE&G Urquhart Station	Aiken County, SC	82.6	82.6
Anderson Regional, Six and Twenty Creek	Anderson County, SC	43.0	-
SCE&G Area Powerhouse	Barnwell County, SC	44.3	44.3

Table 4-12. (cont'd)

Facility	Location	Maximum Daily Withdrawal (mgd)	Monthly Average Withdrawal (mgd)
Savannah River Site K Reactor	Barnwell County, SC	256.00	256.00
Savannah River Site L Reactor	Barnwell County, SC	256.00	256.00
Edgefield County Water and Sewer Authority	Edgefield County, SC	10.0	-
Beaufort-Jasper Water and Sewer Authority	Jasper County, SC	24.00	24.00
McCormick CPW	McCormick County, SC	2.8	-
McCormick CPW	McCormick County, SC	0.5	-
Town of Westminster – Ramsey Creek	Oconee County, SC	3.8	-
Town of Westminster – Chauga River	Oconee County, SC	8.0	-
City of Seneca	Oconee County, SC	18.0	-
City of Walhalla – Coneross Creek	Oconee County, SC	4.3	-
City of Walhalla – Negro Fork	Oconee County, SC	0.1	-
Greenville Water System, Lake Keowee	Pickens County, SC	45.0	-
Town of Pickens – City Reservoir/North Fork	Pickens County, SC	10.6	-
Town of Pickens – Twelvemile Creek	Pickens County, SC	4.0	-
City of Easley	Pickens County, SC	4.0	-

Sources: GDNR 2007a, NRC 2007, SCDHEC 2003

Surface water use in the vicinity of VEGP during the license renewal period is likely to be dominated by four users: VEGP Units 1 and 2 at a permitted withdrawal rate of 127 cfs; SCE&G's D Area Powerhouse at 44.3 cfs; SCE&G's Urquhart Station at 82.6 cfs; and VEGP proposed Units 3 and 4 at 127 cfs (NRC 2007). These four users are expected to incur a total withdrawal of 380.9 cfs. As discussed in Section 2.2.2, the average flow volume in the Savannah River at Augusta is 9,157 cfs (Gotvald et al. 2005), and the expected low flow volume during drought periods is 3,800 cfs (UGA 2006). Therefore, the total withdrawal from the four largest users in the vicinity of VEGP is expected to range from 5 percent of the normal volume to 12 percent of the low flow volume. These withdrawals are not expected to impact the volume of surface water available for other downstream users. Although water availability for other users and for aquatic resources could hypothetically be impacted by a more extreme drought (flow rate down to 957 cfs; SNC 2006a), these impacts would be the result of naturally low precipitation rates, and would not be caused by the water withdrawals.

As discussed in Section 4.5, the other large-scale users of groundwater in the area are located many miles from VEGP, and are unlikely to be affected by groundwater withdrawal at VEGP. Domestic groundwater users are located near the facility, but modeling of groundwater withdrawals from current use (Units 1 and 2) and future use (Units 1, 2, 3, and 4) indicates that these withdrawals are not expected to impact the amount of groundwater available to nearby domestic users. The NRC staff concludes that the minimal impacts on surface water and ground water resources from the continued operation of VEGP Units 1 and 2, as well as from the potential construction and operation of Units 3 and 4, would not contribute to an overall decline in the water resources and would be SMALL Additionally, other past, current, and reasonably foreseeable future actions are estimated to have little impact on water use resources, and therefore, the potential cumulative impact on water resources would be SMALL.

4.8.1.2 Water Quality Impacts

Cumulative impacts may occur with respect to the quality of water within the Savannah River, or within local groundwater resources. These cumulative water quality impacts may occur if operations of other facilities besides VEGP are degrading water quality in the Savannah River or in groundwater aquifers. Water quality degradation may result from changes to water temperatures, or from the release of contaminants into the water sources.

Although it was considered to be a Category 1 issue in the GEIS (NRC 1996), and therefore was concluded to have the potential only for SMALL impacts in Section 4.1, cumulative impacts from heat shock could occur if there were others sources of heated discharge to the Savannah River during the license renewal period. Although several other power plants that may discharge heated water exist on the Savannah River, these are expected to be far enough from VEGP that there is no potential for the thermal plumes to overlap with that from VEGP.

The future operation of VEGP Units 3 and 4 will result in an additional thermal burden on the river at a location near the existing thermal discharge from Units 1 and 2 during the license renewal period. In support of the evaluation of the Early Site Permit (ESP) license for VEGP Units 3 and 4, the NRC Staff performed modeling of the extent of the thermal plume that may result during concurrent operations of all four units. Using a 5°F temperature difference as the standard, this analysis concluded that the maximum possible extent of the plume that would be generated would be 97 ft long by 15 ft wide (NRC 2007). Therefore, cumulative impacts from the thermal discharges would be SMALL.

In Section 2.2.3.1, the release of contaminants into the Savannah River from the operation of VEGP Units 1 and 2 was found to be minor. All discharges of non-radiological constituents are monitored and reported under the NPDES permit (SNC 2007b), while discharges of radionuclides are evaluated as part of the facility REMP (SNC 2007d), as well as the corresponding GEDP radiological monitoring program (GDNR 2004). Both non-radiological and radiological releases were found to be non-existing or minor. Although other facilities in the area (such as SRS) discharge radionuclides to the Savannah River, the REMP and GEDP programs did not identify any concentrations that could potentially cause unacceptable dose rates (SNC 2007d; GDNR 2004). The additional releases from the potential future operation of Units 3 and 4 are not likely to change this conclusion.

Groundwater quality concerns exist in the lower Savannah River basin due to saltwater intrusion into the Floridan Aquifer, resulting from long-term withdrawal of groundwater from this unconfined aquifer near the coast. In 2006, the GDNR issued the "*Coastal Georgia Water and Wastewater Permitting Plan for Managing Salt Water Intrusion*" (GEPD 2006). This plan documented the degradation of groundwater due to withdrawal near the coast, and developed a plan for reviewing and managing future groundwater permit applications to reduce the problem. Although Burke County is not near the coast, and is not one of the counties where salt water intrusion has been documented, it is one of the counties where future groundwater applications will be reviewed to verify that a justified need exists, and that the permittee will use aggressive and practical conservation and reuse principles (GEPD 2006). The groundwater withdrawals associated with the operation of VEGP Units 1 and 2 are already governed by the facility's Water Conservation Plan (SNC 2007e), and future withdrawals to support operation of Units 3 and 4 will be governed by the Water and Wastewater Permitting Plan for Managing Salt Water Intrusion (GEPD 2006).

Additional cumulative impacts to groundwater quality could occur should the facility release radionuclides or other contaminants to the groundwater. As discussed in Section 2.2.3, groundwater monitoring has not historically been a requirement of the facility REMP (SNC 2007d), but measures have recently been taken to implement a monitoring program (SNC 2007f), impacts only existed in the unconfined aquifer, and were the result of atmospheric releases from SRS. There are no known groundwater impacts resulting from VEGP operations, and any future releases from current Units 1 and 2, or from potential future Units 3 and 4, are likely to be strictly monitored according to this new program. While groundwater impacts are known to exist at the SRS, these are not expected to impact the VEGP site across the river. In addition, investigation of elevated tritium concentrations in water wells near VEGP starting in 1988 concluded that the majority of tritium impacts were from SRS (GDNR 2004).

As described above, the NRC staff concludes that the minimal impacts on water quality from the continued operation of VEGP Units 1 and 2, as well as from potential construction and operation of Units 3 and 4, would not contribute to an overall decline in the condition of water quality and would be SMALL. Additionally, other past, current, and reasonably foreseeable future actions are estimated to have little impact on water quality and therefore, the potentially cumulative impact of water quality would be SMALL.

4.8.2 Cumulative Impacts on Aquatic Resources

For the purposes of this analysis, the geographic area considered for cumulative impacts on aquatic resources at the VEGP site includes the Savannah River from Augusta to Savannah, Georgia, Beaverdam Creek, and the waterways crossed by transmission line ROWs. As discussed in Section 4.1, the NRC staff found no new and significant information that would indicate that the conclusions regarding the operation of the VEGP closed-cycle cooling system are inconsistent with the conclusions in the GEIS (NRC 1996). The GEIS concludes that the impacts from issues potentially affecting aquatic resources, such as entrainment, impingement, and heat shock, are small for closed-cycle cooling systems. Accordingly, operation of the VEGP cooling system would not contribute significantly to cumulative impacts on aquatic resources of the Savannah River or its tributaries.

The current and future conditions of the local aquatic resources are influenced by the cumulative effects of past actions. Entrainment and impingement at intake structures of other facilities located on the Savannah River, thermal effects from cooling water discharges, chemical contaminants, environmental changes associated with changes in regional water use, fishing pressures, and habitat modification and loss may have altered the aquatic ecosystem. In addition, changes to water and sediment quality from runoff, urbanization, and industrial activities may act as stressors on the river.

As shown in table 4-12, several facilities currently intake from or discharge into the Savannah River in the area between Augusta and Savanna, Georgia, including SRS, several electric generation facilities located on the Savannah River, a paper mill, and municipal water supply systems; the permitted withdrawal volumes are also listed. Also included are facilities that no longer operate (K and L Reactors at SRS) and facilities that have a reasonably foreseeable potential to operate during the license renewal period (VEGP Units 3 and 4).

Studies on the entrainment due to past reactor operations at SRS have been conducted (DuPont 1987). One study found that in 1983 and 1985, 8 to 12 percent of the ichthyoplankton drifting past the three SRS intake pumphouses on the Savannah River were entrained. However, the study concluded that these high levels of entrainment might not be significant, because: there are many spawning sites for the entrained species in the Savannah River, including downstream; ichthyoplankton typically have naturally high rates of mortality; and there was no evidence to indicate that numbers of ichthyoplankton in the river were decreasing (DuPont 1987). Impingement studies at SRS found very low impingement rates for adult and juvenile fish in general (DuPont 1987), and no impingement of juvenile or adult shortnose sturgeon was found at SRS (Muska and Matthews 1983). The studies conducted in the Savannah River to determine the effects of SRS thermal discharges found no evidence of adverse impacts on the river ecosystem (DuPont 1987). These studies and their conclusions indicate that the historical effects on the aquatic resources of the Savannah River from the operations of SRS facilities were minor, and the current effects of the operation of the D-Area powerhouse are much smaller.

The largest change that is reasonably foreseeable for the area is the possible construction and operation of two additional nuclear units at VEGP, Units 3 and 4. If the units are built, the potential impacts to the Savannah River could include the intake and consumption of water, the discharge of heated effluents, the discharge of chemicals, and the physical impact of some bottom scouring from the discharge. However, due to the design of the new units, including a closed-cycle cooling system, the impact of the potential construction and operation of the new units on the aquatic resources would be minor.

The NRC staff concludes that the minimal impacts on aquatic resources of the Savannah River from the continued operation of VEGP Units 1 and 2, as well as from the potential construction and operation of Units 3 and 4, would not contribute to an overall decline in the condition of the aquatic habitat and associated species, and would be SMALL. Additionally, other past, current, and reasonably foreseeable future actions are estimated to have little impact on aquatic resources, and therefore, the potential cumulative impact on the aquatic resources would be SMALL.

4.8.3 Cumulative Impacts on Terrestrial Resources

This section addresses past, present, and future actions that could result in cumulative impacts on terrestrial resources, including wildlife populations, vegetation communities of uplands, wetlands, and riparian zones, protected species, and land use. For purposes of this analysis, the geographic area considered includes the VEGP site, its immediate surroundings, and its associated transmission line ROWs.

Prior to construction of the VEGP site, terrestrial communities supported forest habitat, floodplain habitat, riparian areas, wetlands, and waterbodies. Construction of the VEGP site caused impacts in the past to terrestrial resources through habitat loss. The clearing of forest communities for the construction of the transmission line ROWs resulted in a subsequent change to the wildlife and plant habitats present at the time and contributed to habitat fragmentation. Habitat fragmentation is a process in which previously contiguous habitats, such as forest, become separated, by clearing of land for roads, agriculture, ROWs, and other development (Franklin, Noon, and George 2002). The six current transmission line ROWs, totaling 6395 ac (2588 ha) of area, traverse mainly agricultural and forest lands and are maintained through a vegetation management program (SNC 2007a). ROW maintenance has likely had impacts on the terrestrial habitats, which may include the spraying of chemicals, prevention of natural succession stages, an increase in edge species, a decrease in interior species, and an increase in invasive species.

There are four generating stations within 90 mi (145 km) of the VEGP site: the SCE&G Urquhart station, 21 mi (34 km) from the VEGP site; the SCE&G D area powerhouse station, 20 mi (32 km) from the VEGP site; the GPC plant McIntosh, 83 mi (134 km) from the VEGP site; and the GPC Port Wentworth, 77 mi (124 km) from the VEGP site. Fossil plants release carbon dioxide, mercury, nitrous oxides, and sulfur dioxide, among other air emissions. Nitrous oxides and sulfur dioxides can combine with water to form acid rain, which can lead to erosion and changes in soil pH levels. Mercury can deposit on soils and surface water, which may then be taken up by terrestrial plant and animal species, and poses the risk of bioaccumulation. For these reasons, the four generating stations are likely to have current and future impacts to the environment on the VEGP site and surrounding area.

There are three non-power generating plants that are on the Savannah River within the geographic area: the International Paper Corporation, the Savannah Industrial and Domestic Water plant and the Beaufort-Jasper Water and Sewer authority wastewater treatment plant. Chemical discharges and the resulting bioaccumulation from these plants have the potential to have impacts on the surrounding area, including vegetation, wildlife, and wetlands.

The SRS, discussed at the beginning of section 4.8, could have impacts on terrestrial habitats. Included in the SRS facility are former nuclear reactors, current operational coal-fired generating plant, and a proposed facility to convert weapons-grade plutonium into nuclear reactor fuel. SRS, when originally constructed, added runoff from additional roads and impervious surfaces, increased development on wetlands and riparian zones, and caused a decrease in the forest habitat. Current operations at SRS, through chemical discharges and water withdrawal, could also have a cumulative impact on the geographic area. Future actions, such as additional construction and maintenance of buildings and facilities could affect the VEGP site and surrounding area.

SNC applied for an ESP for up to two new reactor units (VEGP Units 3 and 4) in 2006 that would be primarily located on previously disturbed land adjacent to the two current units (NRC 2007). In 2007, NRC staff completed an ESP Draft Environmental Impact Statement (EIS) for the two new reactors, including a detailed evaluation of the impacts to terrestrial resources, from the construction of new facilities and disturbance of additional land both on-and off-site (NRC 2007). If the new units are built, one new transmission line ROW would be constructed from the VEGP site to a substation west of Augusta, Georgia. This new transmission line would have a length of 60 mi (96 km) and its associated ROW would have a width of 150 ft (46 m) (NRC 2007). Terrestrial and wetland habitats and the wildlife they support could potentially be affected in the areas where these facilities are constructed.

The NRC staff concludes that the minimal impacts on terrestrial habitat and associated species from the continued operation of VEGP Units 1 and 2, as well as from the potential construction and operation of Units 3 and 4, would not contribute to an overall decline in the condition of the terrestrial resource, and would be SMALL. Additionally, other past, current, and reasonably foreseeable future actions are estimated to have little impact on terrestrial resources, and therefore, the potential cumulative impact on the terrestrial resource would be SMALL.

4.8.4 Cumulative Human Health Impacts

Cumulative adverse impacts on human health potentially could occur as a result of thermophilic microbiological organisms, electromagnetic fields associated with the transmission lines, and radiological exposures.

4.8.4.1 Cumulative Thermophilic Microorganism Impacts

The continued operation of VEPG has a low risk of causing outbreaks from thermophilic microbiological organisms associated with thermal discharges (GDHR 2002, 2006; SCDHEC 2007). Outbreaks of legionellosis, salmonellosis, or shigellosis that occurred in Georgia or South Carolina were within the range of national trends (CDC 1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2005, 2006, 2007c) in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes. As part of its evaluation of cumulative impacts, the NRC staff also considered the effects of thermal discharges from other facilities producing thermal effluents that could promote the growth of thermophilic microbiological organisms. Although several other power plants may discharge heated water to the Savannah River, including the D-Area powerhouse on SRS, these are far enough from VEGP that there is a negligible potential for the thermal plumes to overlap with that from VEGP and result in significant thermal enhancement of the thermophilic microbiological organism populations in the vicinity of VEPG. SNC has indicated that it intends to add additional nuclear power reactors on the VEGP site. The maximum projected cooling tower blowdown from operating two new units is about 1.81 cms (64 cfs), which, when combined with the current blowdown rate of 0.65 cms (22.8 cfs), is still less than 1 percent of the minimum monthly average flow rate of the Savannah River (SNC 2007b). Modeling performed by SNC (SNC 2007b) using the CORMIX mixing zone model predicted a maximum blowdown temperature of 33.1°C (91.5°F). Therefore, this discharge would not cause significant thermal enhancement of the thermophilic microbiological organism populations in the vicinity of VEPG.

On the basis of these considerations, NRC staff has determined that the cumulative impacts to public health from thermophilic microbiological organisms resulting from the VEPG thermal discharge to the aquatic environment or in the vicinity of the site, will be SMALL.

4.8.4.2 Cumulative Electromagnetic Field Impacts

The NRC staff has determined that the electric-field-induced currents from the VEGP transmission lines are below the NESC recommendations for preventing electric shock from induced currents. Therefore, the VEGP transmission lines do not significantly affect the overall potential for electric shock from induced currents within the analysis area. The separation distances between VEGP transmission lines and other transmission lines are substantial and prevent cumulative acute effects from electric-field-induced currents.

With respect to chronic effects from electromagnetic fields, although the NRC staff considers the GEIS finding of "not-applicable" to be appropriate in regard to VEGP, the VEGP transmission lines do not significantly contribute to human exposures to extremely low frequency electric and magnetic fields in the region. Therefore, the NRC staff has determined that the cumulative impacts of the continued operation of the VEGP transmission lines will be SMALL.

4.8.4.3 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers have been developed by the U.S. Environmental Protection Agency (EPA) and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. For the purpose of this analysis, the area within a 50-mi (80-km) radius of the VEGP site was included. The radiological environmental monitoring program conducted by SNC in the vicinity of the VEGP site measures radiation and radioactive materials from all sources, including the SRS; therefore, the monitoring program measures cumulative radiological impacts. Within the 50-mi (80.4 km) radius of the VEGP site is the SRS. SRS was constructed during the early 1950s to produce basic materials (such as plutonium-239 and tritium) used in nuclear weapons. The site covers approximately 310 square miles (803 square kilometers) in South Carolina and borders the Savannah River. As part of normal operations, SRS also releases radioactive effluents, contributing to the cumulative dose impacts to members of the public and the environment.

Monitoring results for the 5-year period from 2002 to 2006 were reviewed as part of the cumulative impacts assessment. In section 2.2.7 and 4.3, the staff concluded that impacts of radiation exposure from VEGP's operation during the renewal term to the public and workers (occupational) are SMALL. The NRC and the State of Georgia would regulate any future actions in the vicinity of the VEGP site that could contribute to cumulative radiological impacts.

SNC has indicated that it intends to add additional nuclear power reactors on the VEGP site. However, cumulative radiological impacts from all uranium fuel cycle facilities, within a 50-mi (80.4 km) radius of the VEGP site, are limited by the dose limits codified in 10 CFR Part 20 and 40 CFR Part 190.

Therefore, the staff concludes that cumulative radiological impacts of continued operations of VEGP are SMALL.

4.8.5 Cumulative Socioeconomic Impacts

As discussed in Section 4.4 of this draft SEIS, the continued operation of VEGP during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already being experienced. Since SNC has indicated that there would be no major plant refurbishment, overall expenditures and employment levels at VEGP would remain relatively constant with no additional demand for housing, public utilities, and public services. In addition, since employment levels and the value of VEGP would not change, there would be no population and tax revenue-related land use impacts. There would also be no disproportionately high or adverse health or environmental impacts on minority and low-income populations in the region. Based on this and other information presented in this draft SEIS, there would be no cumulative socioeconomic impacts from VEGP operations during the license renewal term.

If SNC decides to proceed and construct one or two new nuclear power plant units at the VEGP site, the cumulative short-term construction impacts of this action could be MODERATE to LARGE in counties located in the immediate vicinity of VEGP. These impacts would be caused by the short-term increased demand for rental housing and other commercial and public services used by construction workers during the years of power plant construction. During peak construction periods there would be a noticeable increase in the number and volume of construction vehicles on roads in the immediate vicinity of the VEGP site.

The cumulative long-term operations impacts of this action during the operation of the new power plant unit(s) would be SMALL to MODERATE. These impacts would be caused by the increased demand for permanent housing and other commercial and public services, such as schools, police and fire, and public water and electric services, by the addition of operations workers at the VEGP site during the years of new plant operations. During shift changes there would be a noticeable increase in the number of commuter vehicles on roads in the immediate vicinity of the VEGP site.

Since Burke County is relatively small with less housing and public services available to handle the influx of construction workers in comparison to Columbia and Richmond counties, the cumulative short-term socioeconomic construction impacts on Burke County would likely be MODERATE to LARGE. Over the long-term, cumulative operations impacts on Burke County would likely be

SMALL to MODERATE since new operations workers would likely reside in the same counties and in the same pattern as the current VEGP workforce. Most of the operations workers would be expected to settle where there is more readily available housing in Columbia and Richmond counties.

Because Columbia County is one of the fastest growing counties in the region, the cumulative socioeconomic construction and operations impact are likely to be SMALL when combined with all of the other ongoing public and commercial development projects in the region. Since the majority of the current VEGP workforce and available housing reside in Columbia and Richmond counties, most cumulative socioeconomic impacts would be experienced in these two counties. For the foreseeable future, members of the public would also continue to experience the cumulative socioeconomic impacts from the rapid development of Columbia County. If SNC decides to construct one or two new nuclear power plant units at the VEGP site, the cumulative impacts of this action would likely be SMALL on the three-county socioeconomic region of influence.

The specific impact of this action will ultimately depend on the actual design, characteristics, and construction practices proposed by the applicant. Such details are not available at this time, but if the combined license application is submitted to NRC, the detailed socioeconomic impacts of this action at the VEGP site would be analyzed and addressed in a separate NEPA document that would be prepared by NRC.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither SNC nor the NRC staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with the VEGP operation during the renewal term. Consequently, the Staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Twelve Category 2 issues (including eleven Category 2 issues plus the severe accident mitigation alternatives [SAMAs] issue from Chapter 5) related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. For the 12 Category 2 issues and environmental justice, the Staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS.
Research is continuing in the area of chronic effects of electromagnetic fields, and a scientific consensus has not been reached. Therefore, the Staff did not conduct an evaluation of this issue.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The Staff concluded that cumulative impacts of VEGP license renewal would be SMALL for all potentially affected resources.

4.10 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

59 FR 7629. February 16, 1994. "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." *Federal Register.*

69 FR 52040. August 24, 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register.*

Adkins, C.J. 1984. Equilibrium Thermodynamics, 3rd ed. Cambridge University Press.

Aserkoff, B., S. A. Schroeder, and P. S. Brachman. 1970. Salmonellosis in the U.S.-a five year review. Am. J. Epidemiol. 92:13-24.

Centers for Disease Control and Prevention (CDC). 1997. *Summary of Notifiable Diseases, United States 1996.* Morbidity and Mortality Weekly Report, Vol. 45, No. 53. Atlanta, Georgia. October 31, 1997.

Centers for Disease Control and Prevention (CDC). 1998. *Summary of Notifiable Diseases, United States 1997.* Morbidity and Mortality Weekly Report, Vol. 46, No. 54. Atlanta, Georgia. November 20, 1998.

Centers for Disease Control and Prevention (CDC). 1999. *Summary of Notifiable Diseases, United States 1998.* Morbidity and Mortality Weekly Report, Vol. 47, No. 53. Atlanta, Georgia. December 31, 1999.

Centers for Disease Control and Prevention (CDC). 2001. *Summary of Notifiable Diseases, United States 1999.* Morbidity and Mortality Weekly Report, Vol. 48, No. 53. Atlanta, Georgia. April 6, 2001.

Centers for Disease Control and Prevention (CDC). 2002a. *Summary of Notifiable Diseases United States, 2000.* Morbidity and Mortality Weekly Report, Vol. 49, No. 53. Atlanta, Georgia. June 14, 2002.

Centers for Disease Control and Prevention (CDC). 2002b. *Surveillance for Waterborne-Disease Outbreaks - United States, 1999-2000.* Morbidity and Mortality Weekly Report, Vol. 51 (SS08). Atlanta, Georgia. November 22, 2002.

Centers for Disease Control and Prevention (CDC). 2003. *Summary of Notifiable Diseases - United States, 2001.* Morbidity and Mortality Weekly Report, Vol. 52, No. 40. Atlanta, Georgia. May 2, 2003.

Centers for Disease Control and Prevention (CDC). 2004. *Surveillance for Waterborne-Disease Outbreaks Associated with Recreational Water-United States, 2001-2002.* Morbidity and Mortality Weekly Report, Vol. 53 (SS08). Atlanta, Georgia. October 22, 2004.

Centers for Disease Control and Prevention (CDC). 2005. *Summary of Notifiable Diseases - United States, 2003.* Morbidity and Mortality Weekly Report, Vol. 52, No. 54. Atlanta, Georgia. April 22, 2005.

Centers for Disease Control and Prevention (CDC). 2006. *Summary of Notifiable Diseases - United States,* 2004. Morbidity and Mortality Weekly Report, Vol. 53, No. 53. Atlanta, Georgia. June 16, 2006.

Centers for Disease Control and Prevention (CDC). 2007a. Online access at: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm on July 27, 2007

Centers for Disease Control and Prevention (CDC). 2007b. Online access at: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/salmonellosis_g.htm on July 27, 2007.

Centers for Disease Control and Prevention (CDC). 2007c. *Summary of Notifiable Diseases - United States, 2005.* Morbidity and Mortality Weekly Report, Vol. 54, No. 53. Atlanta, Georgia. March 30, 2007.

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act.* Executive Office of the President, Washington, DC.
Department of Energy (DOE). 1995. *Savannah River Site Waste Management Final Environmental Impact Statement.* DOE/EIS-0217.

E. I. DuPont de Nemours & Co. (DuPont). 1987. *Comprehensive Cooling Water Study, Final Report, Savannah River Plant.* Volume I (DP-1739-1) and Volume V (DP-1739-5). Savannah River Laboratory, Aiken, SC.

Fanning, J.L. 2003. Water Use in Georgia for 2000 and Water-Use trends for 1980-2000. U.S. Geological Survey. Georgia Geologic Survey Information Circular 106.

Fish and Wildlife (FWS). 2007. *Bachman's Warbler (Vermivora bachmanii), 5-Year Review: Summary and Evaluation.* U.S. Fish and Wildlife Service, Charleston, South Carolina.

Franklin, A. B., B. R. Noon, and T. L. George. 2002. "What is Habitat Fragmentation?" Studies in Avian Biology, No. 25: 20-29.

Georgia Department of Human Resources (GDHR). 2002. *Georgia Epidemiology Report.* Vol. 18, No. 1. Division of Public Health, Epidemiology Branch, Atlanta, Georgia.

Georgia Department of Natural Resources (GDNR). 2004. Georgia Environmental Radiation Surveillance Report 2000-2002.

Georgia Department of Human Resources (GDHR). 2006. *Georgia Epidemiology Report.* Vol. 22, No. 8. Division of Public Health, Epidemiology Branch: Atlanta, Georgia. August 2006.

Georgia Department of Natural Resources (GDNR). 2007a. List of Surface Water Permittees. Accessed at http://www.gaepd.org/Files_PDF/regcomm/wpb/swdmuind.pdf on December 24, 2007.

Georgia Department of Natural Resources (GDNR). 2007b. List of Groundwater Permittees. Accessed at http://www.gaepd.org/Files_PDF/regcomm/wpb/gwdmunind_Sept2005.pdf on December 24, 2007

Georgia Environmental Protection Division (GEPD). 2004. *Environmental Radiation Surveillance Report 2000 – 2002.* Environmental Radiation Program. Accessed at http://www.georgiaepd.org/Documents/radrpt2002.html on October 24, 2007.

Georgia Environmental Protection Division (GEPD). 2006. Coastal Georgia Water & Wastewater Permitting Plan for Managing Saltwater Intrusion.

Georgia Power Company. (GPC). 1997. "Maintenance of Plant Vogtle Transmission Line Corridors." Georgia Power Transmission Bulletin Number 6-10. Atlanta, Georgia. May 8.

Gotvald, A. J., J. T. Fisher, C. E. Oberst, and D. L. Calhoun (Gotvald et al). 2005. Water Resources Data-Georgia, 2004. Volume 1: Continuous water-level, streamflow water-quality, and periodic water-quality data, Water Year 2004, B.E. McCallum and D.V. Alhadeff (compilers): Reston, Va., U.S. Geological Survey Water Data Report GA 04-1.

Institute of Environmental Science & Research Limited (ESR). 2002. Accessed at: http://www.nzfsa.govt.nz/science/risk-profiles/salmonella-in-poultry-meat.pdf?bcsi_scan_513F405096A035F7=0&bcsi_scan_filename=salmonella-in-poultry-meat.pdf on July 27, 2007.

Joklik, W.K. and D.T. Smith. 1972. Zinsser Microbiology. Addleton-Century-Croft, New York.

Joklik, W. K, and H. P. Willet. 1976. Zinsser microbiology, 16th ed. Appleton-Century-Crofts, New York.

Muska, C.F. and R.A. Matthews. 1983. *Biological Assessment for the Shortnose Sturgeon, Acipenser brevirostrum, LeSueur 1818, The Savannah River Plant*. DPST-83-754. E.I. DuPont de Nemours & Co., Savannah River Laboratory, Aiken, SC.

National Electrical Safety Code (NESC). 1997. Institute of Electrical and Electric Engineers, New York.

National Marine Fisheries Service (NMFS). 1998. *Recovery Plan for the Shortnose Sturgeon* (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages.

National Marine Fisheries Service (NMFS). 2007. Letter from D. M. Bernhart, Assistant Regional Administrator, Protected Resources Division, to R. Franovich, Branch Chief, Environmental Branch B, Division of License Renewal, Office of Nuclear Reactor Regulation, NRC, Washington, DC. Response to letter of August 22, 2007 from NRC requesting information on federally listed, proposed, and candidate species, critical habitat, and designated essential fish habitat in the vicinity of VEGP and its associated transmission line corridors. September 11.

New South Associates (NSA). 2006a. *Intensive Archaeological Survey of the Proposed Expansion Areas at the Vogtle Electric Generating Plant, Burke County, Georgia.* New South Associates, Stone Mountain, Georgia.

New South Associates (NSA). 2006b. *Addendum Report: Intensive Archaeological Survey of the Proposed Expansion Areas at the Vogtle Electric Generating Plant, Burke County, Georgia.* New South Associates, Stone Mountain, Georgia.

Nuclear Regulatory Commission (NRC). 1985. *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2.* NUREG-1087, Washington, D.C.

Nuclear Regulatory Commission (NRC). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. NUREG-1437 Volumes 1 and 2, Washington, D.C.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, D.C.

Nuclear Regulatory Commission (NRC). 2005. *Environmental Impact Statement on the Construction and Operation of a Proposed Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina.* NUREG-1767, Washington, DC.

Nuclear Regulatory Commission (NRC). 2007. *Draft Environmental Impact Statement for the Early Site Permit for Two Additional Reactors at the Vogtle Electric Generating Plant.* Docket Nos. 50-424 and 50-425, NUREG-1872, Washington, D.C. September.

Portier, C. J., and M. S. Wolfe, eds. 1999. *Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Field.* Working Group Report, National Institute of Environmental Health Sciences of the National Institutes of Health. p. 508.

Reed, M. B., M. T. Swanson, S. Gaither, J. W. Joseph, and W. R. Henry. 2002. *Savannah River Site at Fifty.* U. S. Government Printing Office. Accessed at: www.srs.gov/general/about/50anniv/50anniv.htm on February 5, 2008.

South Carolina Department of Health and Environmental Control (SCDHEC). 2003. Watershed Water Quality Assessment, Savannah River Basin. October 2003.

South Carolina Department of Health and Environmental Control (SCDHEC). 2007. 2005 *South Carolina Annual Report on Reportable Conditions.* Bureau of Disease Control, Columbia, South Carolina. April 2007.

Southern Nuclear Operating Company (SNC). 2006a. Vogtle Electric Generating Plant- Units 1 and 2, Final Safety Analysis Report Revision 13. Burke County, Georgia.

Southern Nuclear Operating Company (SNC). 2006b. "Vogtle Electric Generating Plant Early Site Permit Application, Part 3 -Environmental Report." Public Disclosure Version.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425. June.

Southern Nuclear Operating Company, Inc. (SNC). 2007b. Enclosure 2 to NL-07-2097. Annual Environmental Operating Reports (Nonradiological). Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company, Inc. (SNC). 2007c. Enclosure 2 to NL-07-2097. Monthly Surface Water Withdrawal Reports, 2006. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company, Inc. (SNC). 2007d. *Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2006.*

Southern Nuclear Operating Company, Inc. (SNC). 2007e. Enclosure 2 to NL-07-2097. Groundwater Use Permit 017-0003. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Southern Nuclear Operating Company, Inc. (SNC). 2007f. Enclosure 2 to NL-07-2097. Groundwater Monitoring Plan for Radionuclides. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

Third Rock Consultants (TRC). 2006. *Threatened and Endangered Species Survey Final Report, Vogtle Electric Generating Plant and Associated Transmission Corridors.* January 16.

Todar, K. 2007. Todar's Online Textbook of Bacteriology. Online access at: http://www.textbookofbacteriology.net on July 27, 2007.

Tyndall, R. L., K. S. Ironside, P. L. Metler, E. L. Tan, T. C. Hazen, and C. B. Fliermans. 1989. Effect of thermal additions on the density and distribution of thermophilic amoebae and pathogenic *Naegleria fowleri* in a newly created cooling lake. Appl. Environ. Microbiol. 55:722–732.

U. S. Army Corps of Engineers (USACE). 2007. Concepts of the Savannah River Basin Drought Contingency Plan. Accessed at http://water.sas.usace.army.mil/drought/dcp.cfm on December 24, 2007.

U.S. Census Bureau (USCB). 2000a. "Fact Sheets: Census 2000 Demographic Profile Highlights"; Burke, Columbia, and Richmond Counties, Georgia, and South Carolina." Accessed at http://factfinder.census.gov on December 27, 2007.

U.S. Census Bureau (USCB). 2000b. "P92. Poverty Status in 1999 of Households by Household Type by Age of Householder [59] – Universe: Households. Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data." Accessed at http://factfinder.census.gov/ on January 4, 2008.

U.S. Geological Survey (USGS). 2007a. Savannah River Flow, Annual Statistics, near Augusta, Georgia. Accessed at http://waterdata.usgs.gov/nwis/annual on December 24, 2007.

U.S. Geological Survey (USGS). 2007b. Savannah River Flow near Augusta, Georgia. Accessed at http://waterdata.usgs.gov/nwis/dv on December 24, 2007.

U.S. Geological Survey (USGS). 2007c. Drought Watch - USGS State Information on Drought. Accessed at http://water.usgs.gov/waterwatch on September 14, 2007.

U.S. Geological Survey (USGS). 2007d. Savannah River Flow near Waynesboro, Georgia. Accessed at http://waterdata.usgs.gov/nwis/dv/ on December 4, 2007.

University of Georgia (UGA) Carl Vinson Institute of Government. 2006. Balancing Instream and Offstream Uses: Instream Flows, Surface Storage and Aquifer Management. A Report to the Georgia Environmental Protection Division. Athens, Georgia.

5.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

Environmental issues associated with postulated accidents are discussed in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter describes the environmental impacts from postulated accidents that might occur during the license renewal term.

5.1 Postulated Plant Accidents

Two classes of accidents are evaluated in the GEIS. These are design-basis accidents (DBAs) and severe accidents, as discussed below.

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

5.1.1 Design-Basis Accidents

In order to receive U.S. Nuclear Regulatory Commission (NRC) approval to operate a nuclear power facility, an applicant for an initial operating license must submit a Safety Analysis Report (SAR) as part of its application. The SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents, without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in Title 10, Part 50 and Part 100, of the Code of Federal Regulations (10 CFR Part 50 and 10 CFR Part 100).

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license. The results of these evaluations are found in license documentation such as the applicant's Final Safety Analysis Report (FSAR), the NRC staff's Safety Evaluation Report (SER), the Final Environmental Statement (FES), and Section 5.1 of this Supplemental Environmental Impact Statement (SEIS). A licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant, including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximally exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal period. Accordingly, the design of the plant relative to DBAs during the extended period is considered to remain acceptable, and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, applicable to Vogtle Electric Generating Station (VEGP), is listed in Table 5-1.

Table 5-1. Category 1 Issues Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR PART 51, SUBPART A, APPENDIX B, TABLE B-1	GEIS SECTION
POSTULATED ACCIDENTS	
Design basis accidents	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that

> The NRC staff has concluded that the environmental impacts of design-basis accidents are of small significance for all plants.

Southern Nuclear Operating Company, Inc. (SNC), stated in its Environmental Report (SNC 2007a) that it is not aware of any new and significant information associated with the renewal of the VEGP operating license. The NRC staff has not identified any new and significant information during its independent review of the VEGP Environmental Report, the site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to DBAs beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, regardless of offsite consequences. In the GEIS, the NRC staff assessed the impacts of severe accidents using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

Severe accidents initiated by external phenomena, such as tornadoes, floods, earthquakes, fires, and sabotage, traditionally have not been discussed in quantitative terms in FESs and were not specifically considered for the VEGP site in the GEIS (NRC 1996). However, in the GEIS, the NRC staff did evaluate existing impact assessments performed by the NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from beyond-design-basis earthquakes at existing nuclear power plants is SMALL. Additionally, compliance with the NRC regulatory requirements under 10 CFR Part 73 provide reasonable assurance that the risk from sabotage is SMALL. Even if such events were to occur, the Commission would expect that resultant core damage and radiological releases would be no worse than those expected from internally initiated events. Based on the above, the Commission concludes that the risk from sabotage and beyond design-basis earthquakes at existing nuclear power plants is small and additionally, that the risks from other external events, are adequately addressed by a generic consideration of internally initiated severe accidents.

Based on information in the GEIS, the Commission found that:

> The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

Therefore, the Commission has designated mitigation of severe accidents as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue, applicable to VEGP, is listed in Table 5-2.

Table 5-2. Category 1 Issues Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR PART 51, SUBPART A, APPENDIX B, TABLE B-1	GEIS SECTION	10 CFR 51.53(C)(3)(III) SUBPARAGRAPH	SEIS SECTION
	POSTULATED ACCIDENTS		
Severe Accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	L	5.2

5.2 Severe Accident Mitigation Alternatives

Section 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the Staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for VEGP; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the Severe Accident and Mitigation Alternative (SAMA) evaluation for VEGP conducted by SNC and the NRC staff's review of that evaluation. The NRC staff's review is available in full in Appendix G; the SAMA evaluation is available in full in SNC's ER (SNC 2007a).

The SAMA evaluation for VEGP was conducted with a four-step approach. In the first step SNC quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic risk assessment (PRA) and other risk models.

In the second step SNC examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. SNC initially identified 16 potential SAMAs for VEGP. SNC screened out four SAMAs from further consideration because they were determined to provide no measurable benefit or to have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at VEGP. The remaining 12 SAMAs were subjected to further evaluation.

In the third step SNC estimated the benefits and the costs associated with each of the remaining SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997). The cost of implementing the proposed SAMAs was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). SNC found two SAMAs to be potentially cost-beneficial in the baseline analysis, and two additional SAMAs to be potentially cost-beneficial when analysis uncertainties are considered (SNC 2007a). However, based on more realistic estimates of implementation costs and benefits, SNC determined that the latter two SAMAs would not be cost-beneficial (SNC 2007b).

The potentially cost-beneficial SAMAs do not relate to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. SNC's SAMA analyses and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

SNC submitted an assessment of SAMAs for VEGP as part of the ER (SNC 2007a). This assessment was based on the most recent VEGP PRA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the VEGP Individual Plant Examination (IPE) (SNC 1992) and Individual Plant Examination of External Events (IPEEE) (SNC 1995).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 1.55 x 10^{-5} per year. This CDF is based on the risk assessment for internally-initiated events. SNC did not include the contribution to risk from external events within the VEGP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of two. The breakdown of CDF by initiating event is provided in Table 5-3. The results shown are for Unit 1, but are also representative of those for Unit 2.

Table 5-3. VEGP Core Damage Frequency

Initiating Event	**CDF (Per Year)**	**% Contribution to CDF**
Station Blackout	8.2 x 10^{-6}	54
Loss of Offsite Power	2.4 x 10^{-6}	16
Loss of Nuclear Service Water	1.7 x 10^{-6}	11
LOCA	5.0 x 10^{-7}	3
Loss of DC Bus	4.3 x 10^{-7}	3
Loss of 4.16KV Bus	4.0 x 10^{-7}	3
Loss of Condenser	2.8 x 10^{-7}	2
Steam Generator Tube Rupture	2.8 x 10^{-7}	2
Other Transients	2.0 x 10^{-7}	1
Loss of Feedwater	1.8 x 10^{-7}	1
Turbine Trip	1.4 x 10^{-7}	<1
Reactor Trip	1.2 x 10^{-7}	<1
Spontaneous Reactor Vessel Failure	1.0 x 10^{-7}	<1
Loss of Seal Injection	9.3 x 10^{-8}	<1
Secondary Side Steamline Break	8.9 x 10^{-8}	<1
ATWS	6.2 x 10^{-8}	<1
Inadvertent SI Injection	6.0 x 10^{-8}	<1
Interfacing Systems LOCA	3.0 x 10^{-8}	<1
Loss of ACCW	1.4 x 10^{-8}	<1
Loss of 120V AC Panels	9.8 x 10^{-9}	<1
Loss of Instrument Air	3.7 x 10^{-9}	<1
Total CDF (internal events)	**1.55 x 10^{-5}**	**100**

As shown in Table 5-3, events initiated by station blackout, loss of offsite power, and loss of nuclear service water are the dominant contributors to CDF.

SNC estimated the dose to the population within 80 kilometers (50 miles) of the VEGP site to be approximately 0.0156 person-sievert (Sv)(1.56 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Containment over-pressure failures and containment bypass sequences, such as a steam generator tube rupture accidents, are the dominant contributors to population dose risk at VEGP.

Table 5-4. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose(Person-Rem[1] Per Year)	% Contribution
Intact containment	Negligible	<<1
Containment isolation failure (early)	0.019	1
Containment bypass - ISLOCA (early)	0.166	11
Containment bypass - SGTR (early)	0.337	22
Containment bypass - SGTR (late)	0.198	13
Containment over-pressure failure (late)	0.587	37
Basemat melt-through (late)	0.248	16
Total	**1.56**	**100**

[1]One person-rem = 0.01 person-Sv

The NRC staff has reviewed SNC's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the Staff based its assessment of offsite risk on the CDFs and offsite doses reported by SNC.

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, SNC searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, SNC considered insights from the plant-specific PRA, and SAMA analyses performed for other operating plants that have submitted license renewal applications. SNC identified 16 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

SNC removed four SAMAs from further consideration because they were determined to provide no measurable benefit or to have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at VEGP. A detailed cost-benefit analysis was performed for each of the 12 remaining SAMAs.

The Staff concludes that SNC used a systematic and comprehensive process for identifying potential plant improvements for VEGP, and that the set of potential plant improvements identified by SNC is reasonably comprehensive and, therefore, acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

SNC evaluated the risk-reduction potential of the remaining 12 SAMAs. The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement.

SNC estimated the costs of implementing the 12 candidate SAMAs through the application of engineering judgment, and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they generally include contingency costs associated with unforeseen implementation obstacles.
The Staff reviewed SNC's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is similar to or somewhat higher than what would actually be realized). Accordingly, the Staff based its estimates of averted risk for the various SAMAs on SNC's risk reduction estimates.

The Staff reviewed the bases for the applicant's cost estimates. For certain improvements, the Staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The Staff found the cost estimates to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The Staff concludes that the risk reduction and the cost estimates provided by SNC are sufficient and appropriate for use in the SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by SNC was based primarily on NUREG/BR-0184 (NRC 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed – one at three percent and one at seven percent (NRC 2004). SNC provided both sets of estimates (SNC 2007a, SNC 2007b, SNC 2008).

SNC identified two potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a three percent discount rate). The potentially cost-beneficial SAMAs are:

- SAMA 2 - Maintain full-time black start capability of the Plant Wilson combustion turbines.
- SAMA 4 - Prepare procedures and operator training for cross-tying an opposite unit diesel generator.

SNC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (SNC 2007a). If the benefits are increased by a factor of 2 to account for uncertainties, two additional SAMA candidates were determined to be potentially cost-beneficial:

- SAMA 6 – Implementation of a bypass line for the cooling tower return isolation valves.
- SAMA 16 – Enhance procedures for Interfacing Systems Loss of Coolant Accidents (ISLOCA) response.

However, based on more realistic estimates of implementation costs and benefits, SNC determined that the latter two SAMAs would not be cost-beneficial (SNC 2007b). The Staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

5.2.6 Conclusions

The Staff reviewed SNC's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by SNC are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PRA, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and increasing the estimated SAMA benefits for internal events by a factor of two to account for potential benefits in external events. Based on its review of the SAMA analysis, the Staff concurs with SNC's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the Staff considers that further evaluation of the two potentially cost-beneficial SAMAs by SNC is warranted. However, none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.3 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 73. Code of Federal Regulations, Title 10, *Energy,* Part 73, "Physical Protection of Plants and Materials."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy,* Part 100, "Reactor Site Criteria."

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.
Nuclear Regulatory Commission (NRC). 1997. *Regulatory Analysis Technical Evaluation Handbook*. NUREG/BR-0184, Washington, D.C.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission*. NUREG/BR-0058, Rev. 4, Washington, D.C.

Southern Nuclear Operating Company (SNC). 1992. "Vogtle Electric Generating Plant Unit 1 and 2, Individual Plant Examination Report," November 1992.

Southern Nuclear Operating Company (SNC). 1995. "Vogtle Electric Generating Plant Unit 1 and 2, Individual Plant Examination of External Events," November 1995.

Southern Nuclear Operating Company (SNC). 2007a. *Applicant's Environmental Report-Operating License Renewal Stage for Vogtle Electric Generating Plant Units 1 and 2, Appendix E - Environmental Report,* Southern Nuclear Operating Company, Birmingham, Alabama. June 2007.

Southern Nuclear Operating Company (SNC). 2007b. Letter from Tom E. Tynan, Southern Nuclear Operating Company, to U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Southern Nuclear Operating Company, Vogtle License Renewal Application, Request for Additional Information Regarding the Analysis of Severe Accident Mitigation Alternatives," dated December 20, 2007.

Southern Nuclear Operating Company (SNC). 2008. Letter from Tom E. Tynan, Southern Nuclear Operating Company, to U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Southern Nuclear Operating Company, Vogtle License Renewal Application, Follow Up to Severe Accident Mitigation Alternatives Request for Additional Information, Review Questions," dated February 1, 2008

6.0 Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management

Environmental issues associated with the uranium fuel cycle and solid waste management are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1; therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, and are applicable to Vogtle Electric Generating Plant (VEGP). The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The U.S. Nuclear Regulatory

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Commission (NRC) staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to VEGP from the uranium fuel cycle and solid waste management are listed in Table 6-1.

Table 6-1. Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Off-site radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Off-site radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Off-site radiological impacts (spent fuel and high level waste disposal)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste storage and disposal	6.1; 6.2.2.2; 6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6; 6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
On-site spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

Southern Nuclear Operating Company, Inc. (SNC) stated in its Environmental Report (Environmental Report; SNC 2007) that it is not aware of any new and significant information associated with the renewal of the VEGP operating license. The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the Staff concluded in the GEIS that the impacts are SMALL except for the collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the Staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of these issues follows:

- Off-site radiological impacts (individual effects from other than the disposal of spent fuel and high level waste). Based on information in the GEIS, the Commission found that:

  > Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part (10 CFR 51.51[b]). Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no off-site radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Off-site radiological impacts (collective effects). Based on information in the GEIS, the Commission found that:

  > The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next one thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are

very small fractions of regulatory limits and even smaller fractions of natural background exposure to the same populations.

Nevertheless, despite all of the uncertainty, some judgement as to the regulatory NEPA (National Environmental Policy Act of 1969, as amended) implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the Staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no off-site radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Off-site radiological impacts (spent fuel and high level waste disposal). Based on information in the GEIS, the Commission found that:

  For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for off-site releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards" (NAS 1995), and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 3×10^{-3}.

  Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980 (DOE 1980). The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, U.S. Environmental Protection Agency's (EPA's) generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths world-wide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all of the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

On February 15, 2002, based on a recommendation by the Secretary of the Department of Energy, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and high-level waste. The U.S. Congress approved this recommendation on July 9, 2002, in Joint Resolution 87, which designated Yucca Mountain as the repository for spent nuclear waste. On July

23, 2002, the President signed Joint Resolution 87 into law; Public Law 107-200, 116 Stat. 735 (2002) designates Yucca Mountain as the repository for spent nuclear waste. This development does not represent new and significant information with respect to the off-site radiological impacts from license renewal related to disposal of spent nuclear fuel and high-level waste.

The EPA developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000 year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63.

Therefore, for the high-level waste and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for off-site releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, it was assumed that limits would be developed in line with the 1995 NAS report, *Technical Bases for Yucca Mountain Standards* (NAS 1995), and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository that would comply with such limits could and likely would be developed at some site. Peak doses to virtually all individuals would be 100 mrem per year or less.

Despite the current uncertainty with respect to these rules, some judgment as to the 1969 NEPA implications of off-site radiological impacts of spent fuel and high-level waste disposal should be made. The Staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no off-site radiological impacts related to spent fuel and high-level waste disposal during the renewal term beyond those discussed in the GEIS.

- <u>Nonradiological impacts of the uranium fuel cycle</u>. Based on information in the GEIS, the Commission found that:

  The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the Staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Low-level waste storage and disposal. Based on information in the GEIS, the Commission found that:

> The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no impacts of low-level waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Mixed waste storage and disposal. Based on information in the GEIS, the Commission found that:

> The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- On-site spent fuel. Based on information in the GEIS, the Commission found that:

  > The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no impacts of on-site spent fuel associated with license renewal beyond those discussed in the GEIS.

- Nonradiological waste. Based on information in the GEIS, the Commission found that:

  > No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

- Transportation. Based on information contained in the GEIS, the Commission found that:

  > The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU (megawatt-days per metric ton of uranium) and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4 – Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.

  VEGP meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site audit, the scoping process, or evaluation of other available information. Therefore, the Staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

There are no Category 2 issues for the uranium fuel cycle and solid waste management.

6.2 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 63. Code of Federal Regulations, Title 10, *Energy,* Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR Part 191. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS-0046F, Washington, DC.

Joint Resolution 87, 2002. Public Law 107-200, 116 Stat 735.

National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards.* Washington, DC.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et. seq.

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, *"Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Southern Nuclear Operating Corporation (SNC). 2007. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425.

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, Supplement 1 (NRC 2002). The Staff's evaluation of the environmental impacts of decommissioning presented in NUREG-0586, Supplement 1 identifies a range of impacts for each environmental issue.

Additionally, the incremental environmental impacts associated with decommissioning activities resulting from continued plant operation during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues were then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1; therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

---

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

7.1 Decommissioning

Category 1 issues in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B that are applicable to Vogtle Electric Generating Plant (VEGP) decommissioning following the renewal term are listed in Table 7-1. Southern Nuclear Operating Company, Inc. (SNC) stated in its Environmental Report (Environmental Report; SNC 2007) that it is not aware of any new and significant information regarding the environmental impacts of VEGP license renewal. The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the Staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of VEGP Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
DECOMMISSIONING	
Radiation doses	7.3.1; 7.4
Waste management	7.3.2; 7.4
Air quality	7.3.3; 7.4
Water quality	7.3.4; 7.4
Ecological resources	7.3.5; 7.4
Socioeconomic impacts	7.3.7; 7.4

A brief description of the Staff's review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of the issues follows:

- Radiation doses. Based on information in the GEIS, the Commission found that:

  > Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Waste management. Based on information in the GEIS, the Commission found that:

> Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Air quality. Based on information in the GEIS, the Commission found that:

> Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Water quality. Based on information in the GEIS, the Commission found that:

> The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Ecological resources. Based on information in the GEIS, the Commission found that:

    Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Socioeconomic Impacts. Based on information in the GEIS, the Commission found that:

    Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

  The Staff has not identified any new and significant information during its independent review of the VEGP Environmental Report (SNC 2007), the site visit, the scoping process, or its evaluation of other available information. Therefore, the Staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants.* NUREG-1437 Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants."* NUREG-1437 Volume 1, Addendum 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586 Volumes 1 and 2, Supplement 1, Washington, DC.

Southern Nuclear Operating Company, Inc. (SNC). 2007. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425.

8.0 Environmental Impacts of Alternatives to License Renewal

In this chapter, U.S. Nuclear Regulatory Commission (NRC) staff examines the potential environmental impacts associated with alternatives to renewing the Vogtle Electric Generating Plant (VEGP) Units 1 and 2 operating licenses. NRC staff considers the following alternatives: 1) denying the renewal of an operating license (i.e., the no-action alternative); 2) implementing electric generating sources other than VEGP; 3) relying on conservation to offset a portion of VEGP's capacity; 4) purchasing electric power from other sources; and 5) implementing a combination of generation and conservation measures. In addition, NRC staff briefly discusses other generation alternatives that they deemed incapable of individually replacing the power generated by VEGP.

The NRC staff evaluates environmental impacts across 11 categories (land use, ecology, water use and quality, air quality, waste, human health, socioeconomics, transportation, aesthetics, historical and archaeological resources, and environmental justice) using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE. NRC developed these standards by using the Council on Environmental Quality (CEQ) guidelines. NRC staff outlines these standards in the footnotes to Table B-1 of Title 10 of the *Code of Federal Regulations* (CFR), Part 51, Subpart A, Appendix B:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories NRC staff used in this chapter are the same categories NRC staff used in the license renewal Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437 Volumes 1 and 2 (NRC 1996, 1999)[(a)], with the additional impact category of environmental justice.

In examining various energy alternatives for this draft supplemental environmental impact statement (SEIS), NRC staff evaluated information presented in the Environmental Report. As part of its independent review, NRC staff conducted additional research and analysis that at

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

times led to conclusions that diverge from the applicant's. Where appropriate, these differences are discussed in this chapter.

8.1 No-Action Alternative

NRC regulations implementing the National Environmental Policy Act of 1969, as amended (NEPA), require NRC staff to discuss the no-action alternative in any NRC environmental impact statement (EIS, see 10 CFR Part 51, Subpart A, Appendix A(4)). For license renewal, the no-action alternative means that NRC does not renew the VEGP operating licenses. The VEGP operating licenses would then expire in 2027, and 2029 causing Southern Nuclear Operating Company, Inc. (SNC) to cease plant operations.

If, after performing safety and environmental reviews of VEGP's license renewal application, NRC acts to renew those operating licenses, then SNC may choose to continue operating VEGP throughout the renewal term. If this occurs, then shutdown of the unit and decommissioning activities would be postponed for up to an additional 20 years. NRC staff expects that the impacts of decommissioning after 60 years of operation would not differ significantly from those that would occur after 40 years of operation.

NRC staff addresses the environmental impacts of decommissioning in several documents, including the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002); the license renewal GEIS (NRC 1996); and Chapter 7 of this draft SEIS. These analyses either directly address or bound the environmental impacts of decommissioning whenever SNC ceases operating VEGP.

These documents do not, however, address environmental impacts that occur after plant shutdown and before the actual decommissioning process begins. In the following section, NRC staff considers the immediate impacts from plant shutdown. The impacts are summarized in Table 8-1.

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comment
Land Use	SMALL	Impacts are expected to be SMALL because plant shutdown is not expected to result in changes to onsite or offsite land use.
Ecology	SMALL	Impacts from shutdown are expected to be SMALL because aquatic impacts are generally reduced and terrestrial impacts are not expected because there would not be any land use or maintenance changes.

Table 8-1. (cont'd)

Impact Category	Impact	Comment
Water Use and Quality—Surface Water	SMALL	Impacts are expected to be SMALL because surface water intake and discharges would decrease.
Water Use and Quality—Groundwater	SMALL	The current plant uses groundwater for several services. Shutdown would reduce groundwater withdrawals.
Air Quality	SMALL	Impacts are expected to be SMALL because emissions related to plant operation and worker transportation would decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste would stop, and generation of low-level and mixed waste would decrease.
Human Health	SMALL	Impacts are expected to be SMALL because radiological doses to workers and members of the public, which are currently within regulatory limits, would be reduced.
Socioeconomics	MODERATE to LARGE	Impacts in Burke County because of lost jobs and tax revenue.
Socioeconomics (Transportation)	SMALL	Impacts are expected to be SMALL because of the decrease in commuter traffic to the plant.
Aesthetics	SMALL	Impacts are expected to be SMALL because plant structures would remain in place.
Historic and Archaeological Resources	SMALL	Impacts are expected to be SMALL because shutdown of the plant would not change land use or disturbance.
Environmental Justice	MODERATE to LARGE	Economic impacts in Burke County include loss of jobs and tax revenue, resulting in reduced services available to minority and low-income populations in the county.

- Land Use

Onsite land use would not be affected immediately by the cessation of operations. Plant structures and other facilities would likely remain in place until decommissioning. In the near term, transmission lines associated with VEGP are likely to remain in-place until decommissioning. In the long run, the transmission lines could be used to deliver the output of any new capacity additions made on the VEGP site. As a result, maintenance of the right-of-ways would continue as before. Since continued operations would have no significant impact on onsite and offsite land use, and as plant shutdown would have little or no immediate effect on land use practices, the NRC staff concludes that the impacts to land use from plant shutdown would be SMALL.

- Ecology

  Ecology would be minimally affected by plant shutdown. VEGP utilizes two natural draft cooling towers rather than once-through cooling; the cooling tower makeup requirements represent approximately one percent of Savannah River discharges (at Augusta, Georgia) under average flow conditions and less than two percent of River discharges under drought conditions. As a result aquatic ecological impacts from continued plant operations are expected to be SMALL (see Chapter 4) and, therefore, the impacts of the No Action Alternative are also expected to be SMALL (but positive). SNC would most likely continue to maintain VEGP's transmission line right-of-ways (ROWs) as discussed above (see Land Use). Since the NRC staff determined that continued operation of VEGP into the license renewal term would have SMALL impacts to ecology, and since few changes would occur to ecological resources following shutdown, the NRC staff concludes that ecological impacts from shutdown of the plant would be SMALL.

- Water Use and Quality—Surface Water

  When the plant stops operating, consumptive water use for cooling tower makeup would immediately cease and VEGP would also cease discharging a cooling tower blow-down stream to the Savannah River. As a consequence, termination of operations at VEGP would have a positive impact to surface water use and quality. Since the NRC staff determined in Chapter 4 that continued operation would have a SMALL impact on surface water quality and use, cessation of these impacts would also be SMALL.

- Water Use and Quality—Groundwater

  VEGP currently relies on surface water from the Savannah River for cooling tower makeup. However, groundwater is used for nuclear service system cooling, plant water treatment, fire protection, potable and sanitary purposes and irrigation. Groundwater is provided from two main production wells and a number of secondary withdrawal points. In the recent past, groundwater withdrawals at VEGP have averaged approximately 1.05 million gallons per day (mgd) while the site is permitted to withdraw 5.5 mgd. If the VEGP license is not renewed and SNC, as a result, shuts the plant down, groundwater needs would significantly diminish but would not entirely cease. Since NRC staff determined in Chapter 4 that continued operation of VEGP would have no impact on groundwater resources, a small, positive impact from plant shutdown would result in a SMALL overall impact to groundwater use and quality from plant shutdown.

- Air Quality

When the plant stops operating, there would be a reduction in emissions from activities related to plant operation such as use of diesel generators and workers' vehicles. In Chapter 4, NRC staff determined that these emissions would have a SMALL impact on air quality during the renewal term. Therefore, if the emissions decrease, the impact to air quality would also decrease and would be SMALL.

- Waste

When the plant stops operating, it would stop generating high-level waste, and it would generate less low-level and mixed waste from plant operation and maintenance. Since the NRC staff determined in Chapter 6 that continued low-level and mixed waste generation would have a SMALL impact, a reduction in waste generation would have an even smaller impact. Therefore, the NRC staff concludes that waste impacts from plant shutdown would be SMALL, and less than during operation.

- Human Health

After shutdown the plant would release smaller amounts of radioactive gaseous and liquid materials to the environment than it did while operating. In addition, the variety of potential accidents at the plant would decline to a limited set associated with shutdown events and fuel handling. Since NRC staff determined in Chapter 4 that continued plant operations would have a SMALL impact on human health, and since NRC staff also determined in Chapter 5 that potential accidents during the renewal term would have a SMALL impact, then reducing the amounts of gaseous and liquid releases while simplifying and limiting the types of potential accidents the plant may experience would further reduce impacts to human health. Impacts to human health from plant shutdown, then, are SMALL.

- Socioeconomics

Should the VEGP operating licenses not be renewed, the loss of local tax revenues could have a MODERATE to LARGE socioeconomic impact within Burke County. These effects could be somewhat offset by the relatively long term decommissioning activities that would accompany shut down. Construction of an alternative energy technology at the site would also tend to offset socioeconomic impacts, as discussed in the following sections. The NRC staff determined in Chapter 4 that continued plant operations would have no effect on socioeconomic conditions in the region since the impacts from plant operations have long since become a part of Burke County and the region's socioeconomic condition. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential socioeconomic impacts of plant decommissioning.

- Transportation

  Cessation of operations would be accompanied by reduced traffic in the vicinity of the plant. This reduction occurs largely because the post-shutdown workforce would be smaller than the operating workforce. Shipments of materials to and from the plant would also decrease. As the NRC staff determined in Chapter 4 that continued operational transportation impacts would have a SMALL impact, a reduction in these effects means that impacts remain SMALL if the plant shuts down.

- Aesthetics

  Plant structures and other facilities are likely to remain in place until decommissioning. Plumes from the cooling towers would cease or greatly decrease after shutdown. Therefore, the NRC staff concludes that the aesthetic impacts of plant closure would be SMALL.

- Historic and Archaeological Resources

  Onsite lands and underlying archaeological resources would not be affected immediately by shutdown, as plant structures and other facilities are likely to remain in place until decommissioning. SNC may continue to maintain the transmission line corridors leading from VEGP, at least through the period of decommissioning, and continue that maintenance activity as part of the process of developing alternative capacity at the site. As NRC staff determined in Chapter 4 that these practices would have a SMALL impact on historic and archaeological resources, then continuation of these practices after plant shutdown would also have SMALL impacts.

- Environmental Justice

  Impacts to minority and low-income populations when VEGP ceases operation would depend on the number of jobs and the amount of tax revenues lost by the communities surrounding the power plant. Closure of VEGP would reduce the overall number of jobs (there are currently 862 permanent positions at the plant) and the tax revenue attributed to plant operations (approximately 75 percent of Burke County's tax revenues are from VEGP). Since VEGP's tax payments represent such a significant percentage of Burke County's total annual property tax revenue, it is likely that economic impacts would range from MODERATE to LARGE should VEGP be shutdown and closed. Therefore, minority and low-income populations in the vicinity of VEGP could experience a disproportionately high and adverse socioeconomic impact from plant shutdown.

8.2 Alternative Energy Sources

In this section, NRC staff discusses the environmental impacts of alternatives to license renewal that would meet system energy needs after the expiration of VEGP's current licenses or whenever SNC elects to cease operating VEGP. These alternatives include alternate sources of electric power (generation alternatives and purchased power), as well as energy conservation. If NRC renews the VEGP operating licenses, the decision of whether to continue operating the plant or whether to rely on an alternative is left to SNC and state-level energy decision makers.

The NRC staff considers the following generation alternatives in detail:

- Supercritical coal-fired generation at the VEGP site and at an alternate site (Section 8.2.1)
- Integrated gasification combined-cycle (IGCC) coal-fired generation at the VEGP site and at an alternate site (Section 8.2.2)
- Natural gas combined-cycle generation at the VEGP site and at an alternate site (Section 8.2.3)
- New nuclear generation at the VEGP site and an alternate site (Section 8.2.4)

The NRC staff considers the following non-generation alternatives to license renewal in detail:

- Utility-sponsored conservation[b] programs (Section 8.2.5)
- Purchased power (Section 8.2.6)

The order of alternatives does not imply which alternatives the NRC staff considers most likely or most environmentally benign.

The NRC staff addresses other alternatives considered in Section 8.2.7. Section 8.2.8 presents the environmental impacts of a combination of alternatives that the NRC staff determined to be insufficient as stand-alone alternatives to VEGP license renewals, but could potentially replace VEGP when presented collectively.

Each year the Energy Information Administration (EIA), a branch of the U.S. Department of Energy (DOE), issues the updated *Annual Energy Outlook* (*AEO*). The *AEO* is a forecasting document that analyzes trends and issues in energy production, supply, and consumption in

(b) NRC staff notes that conservation typically refers to all programs that reduce energy consumption, while energy efficiency refers to programs that reduce consumption without reducing services. For this section, NRC staff will use the terms interchangeably.

order to project future energy developments. The projections in the *AEO* vary from year to year based on current events. Its comprehensiveness and policy-neutrality is unique among forecasting documents. In the *Annual Energy Outlook 2007 with Projections to 2030*, EIA projects a continued nationwide increase in energy consumption and generating capacity (DOE/EIA 2007a). Early in this period, through 2010, EIA projects that gas-fired combined-cycle or combustion turbine technology will account for most generating capacity additions. As natural gas prices increase, coal-fired generation begins to account for the largest share of capacity additions. EIA projects that coal will account for the majority (54 percent) of new capacity through 2030. EIA also projects that advanced coal technologies, such as coal-fueled integrated gasification combined-cycle generation, will decline in cost relative to improved natural-gas-fired combined-cycle technologies. EIA projections indicate that U.S. generators will increase total nuclear and renewable generation capacity throughout the forecast term, due partly to tax credits and other incentives. As a proportion of installed capacity, however, nuclear generation will decrease slightly through 2030, while renewables share will remain relatively constant (DOE/EIA 2007a). EIA indicates that changes in electricity generation costs, which are highly dependent on emissions-control costs, will drive utilities' choices in generating technologies.

EIA asserts that oil-fired plants will account for virtually no new generation capacity in the U.S. through 2030, and furthermore projects a 0.6 percent annual decrease in electric sector oil consumption because of higher fuel costs and lower efficiencies relative to other technologies (DOE/EIA 2007a). Given EIA's analysis, NRC staff will not consider an oil-fired alternative for VEGP.

VEGP has an approximate net electrical output of 2,301 megawatts electric (MW[e]) total. To simplify the alternatives analysis in the Environmental Report, SNC developed a set of fossil-fueled alternatives that would approximately, but not completely; replace this capacity (SNC 2007a). The staff, however, as part of their independent review of the Environmental Report, has decided to consider alternatives that have the capability to deliver the approximate net electrical output of the VEGP units and, thus, has not followed the approach taken in the Environmental Report. This applies to the gas-fired, supercritical coal-fired, and integrated gasification combined-cycle coal-fired alternatives[c] evaluated in the following sections.

Given that the VEGP is situated on a 3,169-acre (ac) site, along the Savannah River, and the fact that considerable power plant infrastructure is already in-place there, including transmission facilities, administrative facilities and rail link, the NRC staff believes that the site can readily

(c) While supercritical coal-fired plants rely on conventional boiler technology operated at higher pressures and temperatures, integrated gasification combined-cycle (IGCC) plants use coal (or other solid or liquid feedstock) to produce syngas that burns in a combined-cycle plant similar to that used for natural gas. Thus, an approximation of this sort is also necessary for the IGCC alternative. Boiler-based coal plants of this size are typically built-to-specifications.

support construction and operation of the alternatives evaluated herein. NRC staff notes that SNC's plans for two additional nuclear units at the VEGP site would encumber some land area that could potentially be used for the alternatives being considered herein. However, even accounting for those new nuclear units, sufficient land should be available for the development of alternatives. In addition to considering impacts from alternatives developed at the VEGP site, the NRC staff will also generally characterize impacts for alternate sites. These sites could potentially be located on either previously undisturbed land (i.e. greenfield sites) or areas previously used for various commercial or industrial purposes (i.e. brownfield sites). Similarly, alternative sites may be located near either urban or rural areas. As such, the potential impacts outlined for alternative sites capture a range of corresponding impacts.

Although the operating license renewal period is only 20 years, NRC staff analyzed the impact of operating the coal, gas, and nuclear alternatives for 40 years, as this is a reasonable projection of the operating life of such plants. This means that only half of certain impacts (land use for waste disposal and coal mining, for example) are directly attributable to the 20 year license renewal period.

8.2.1 Supercritical Conventional Coal-Fired Generation

In this section, NRC staff analyzes new supercritical coal-fired boilers as the first of two coal-fired alternatives. Supercritical coal-fired plants are similar to other coal burners except they operate at somewhat higher temperatures and pressures, which allows for greater thermal efficiency. Supercritical coal-fired boilers are commercially proven and represent an increasing proportion of new coal-fired power plants. In Section 8.2.2, NRC staff presents the second coal based alternative, *i.e.*, an IGCC plant.

NRC staff considers constructing supercritical coal-fired power plants at both the VEGP site and at an alternate site. Developing a coal-fired facility at an alternate site may involve developments not needed at VEGP such as new transmission lines connecting the alternate site to the SNC system and a new rail connection for coal and lime deliveries. The impacts of building and operating a transmission and rail corridor would vary depending on location of the alternate site.

NRC staff's analysis assumes a plant efficiency or heat rate of 8,844 British thermal units (BTU) per kilowatt-hour (kWh), the value EIA reports as the heat rate for new, scrubbed coal plants in 2005 (DOE/EIA 2006). Additionally, the staff assumes that the alternative technologies evaluated herein would have to be capable of providing the full net electrical capacity of VEGP (2,301 MW[e]).

To do so, three units having an approximate gross capacity of 813 MW(e) (767 MW[e] net output per unit), would need to be constructed when account is taken of the approximately 6 percent plant output that would be needed on site.

The supercritical coal-fired facility with a gross output of approximately 2,439 MW(e) would consume approximately 7 million tons per year (yr) of bituminous coal with an ash content of approximately 8.83 percent (based on averages for Georgia coal consumption; (DOE/EIA 2007b) and sulfur content of 0.8 percent. As in SNC's analysis, NRC staff assumed a capacity factor[(d)] of 0.85 for the supercritical coal-fired alternative (SNC 2007b).

At the VEGP site, a coal-fired alternative would likely receive coal and lime (used to scrub sulfur oxides from flue gases) by rail. The coal-fired option would likely receive between 1 and 2 unit trainloads of coal per day (assuming each train has 100 cars with 100 tons of coal per car). SNC would have to improve VEGP's existing rail connection to facilitate these deliveries. Impacts from improving the rail spur onto the VEGP site would be SMALL since the rail line is already in-place and it is not expected that ROW acquisitions would be necessary.

In evaluating the supercritical coal-fired alternative, the NRC staff assumed that a new plant located at either the VEGP site or an alternate site would use a closed-cycle cooling system, as is the case for the two nuclear units at VEGP. NRC staff discusses the overall impacts of the supercritical coal-fired generating alternative in the following sections and summarizes these impacts in Table 8-2. As mentioned, the extent of impacts at an alternate site would depend on the location and characteristics of the particular site selected.

Table 8-2. Summary of Environmental Impacts of Supercritical Conventional Coal-Fired Generation at VEGP Site and at an Alternate Site Using Closed-Cycle Cooling

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land Use	MODERATE	Uses approximately 800 additional on-site acres for plant and waste disposal; additional offsite land impacts for coal and limestone mining affects thousands of acres.	MODERATE To LARGE	Uses approximately 1,150 acres for plant, offices, parking, and waste disposal; additional impacts from transmission line, and rail spur, as well as coal and limestone mining.

(d) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Table 8-2. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Ecology	MODERATE	Uses undeveloped areas at current VEGP site, plus existing rail and transmission corridors; impacts also dependent on land used for coal and limestone mining.	MODERATE to LARGE	Impact depends on location and ecological value of site, surface water body used for intake and discharge, and transmission line and rail routes; may cause habitat loss and fragmentation, as well as reduced productivity and biological diversity; impact also dependent on coal and limestone mining.
Water Use and Quality—Surface Water	SMALL	Uses existing cooling tower system. Reduced heat rate allows the supercritical coal-fired alternative to use less water than the existing plant.	SMALL to MODERATE	With closed-cycle cooling, the impact would likely be SMALL, though it would depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality—Groundwater	SMALL	A new plant onsite would likely continue to rely on groundwater for only miscellaneous plant services.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the aquifers, though groundwater would not likely be used for cooling tower makeup purposes.

Table 8-2. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Air Quality	MODERATE	• Sulfur oxides (5,600 tons/yr) • Nitrogen oxides (1,820 tons/yr) • Total suspended particulates (320 tons/yr) • PM_{10} (73 tons/yr) • Carbon monoxide (1,820 tons/yr) • Small amounts of mercury and other hazardous air pollutants.	MODERATE	Potentially the same impacts as the VEGP site, although pollution-control standards may vary.
Waste	MODERATE	Total waste production would be approximately 64,000 tons /yr of ash (after 90 percent recycling) and 304,000 tons/yr scrubber sludge requiring approximately 220 on-site acres for disposal over the 40-year life of the plant. The plant would also generate relatively small amounts of conventional, hazardous, and universal wastes during operation.	MODERATE	Same impacts as at VEGP site; waste disposal constraints may vary.
Human Health	SMALL	Impacts are uncertain, but considered SMALL as the plant would comply with health-informed standards in the Clean Air Act (CAA) and other relevant emissions regulations.	SMALL	Similar impacts to those at the VEGP site.

Table 8-2. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 2,000 workers would be onsite during the peak period of construction, followed by a reduction from the current VEGP work force of 862. Tax base would be preserved and, therefore, long term impacts considered to be SMALL to MODERATE.	SMALL to LARGE	Construction impacts depend on location, but would be MODERATE to LARGE if the plant is located in an area that is rural. Burke County will lose approximately 75 percent of tax revenue resulting in a potentially MODERATE to LARGE impact to the County. Employment loss would be offset over time as regional economy grows. Impacts near an urban area may be SMALL.
Socioeconomics (Transportation)	SMALL to MODERATE	Construction phase transportation impacts would be SMALL to MODERATE. For rail transportation of coal and lime, the impacts would likely affect traffic on roadways along rail corridor at grade crossings.	SMALL to LARGE	Transportation impacts could be SMALL to LARGE, during construction. For rail transportation of coal and lime, the impact is likely to be SMALL to LARGE depending on the routing of coal trains.
Aesthetics	SMALL to MODERATE	Some aesthetic impact due to tall stacks. Current site usage mitigates impacts. Noise impacts of nighttime coal and lime delivery via rail to VEGP site.	SMALL to LARGE	The greatest impacts would be from new transmission lines, plant stacks, and rail lines to transport coal and lime.. Impacts range from SMALL to LARGE depending on the nature of the site.

Table 8-2. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Historic and Archeological Resources	SMALL	Most construction would affect previously developed parts of the VEGP site; a cultural resource inventory and mitigation measures would minimize any impacts on undeveloped lands.	SMALL to MODERATE	An alternate location would necessitate cultural resource studies; construction would likely avoid highly sensitive areas. Impacts would be managed or mitigated.
Environmental Justice	SMALL	Impacts on minority and low-income communities would be similar to those experienced by the population as a whole, which are SMALL. Some additional impacts on rental housing may occur during construction, though these likely would not be noticeable.	SMALL to LARGE	Impacts to minority and low income populations in Burke County would be due to lost tax revenue based services and jobs. Impacts at alternate sites would vary depending on population distribution and location of the site.

- Land Use

Using the National Energy Technology Laboratory (NETL) 2007 Coal Power Plant Database (NETL 2007) the NRC staff evaluated land requirements for large (greater than 700 MW[e]) coal-fired generating stations. Land requirements were estimated for each large generating station using aerial photography available on-line. As a result of that evaluation NRC staff noted that there appears to be little correlation between plant area and plant capacity. For example, an Ohio plant, W.H. Zimmer, with a net capacity of 1,426 MW(e) has an approximate footprint of 111 acres (0.08 ac/MW[e]) while the Shelburne Station (Minnesota), with a net capacity of 809 MW(e), has an approximate footprint of 1,937 acres (2.4 ac/MW[e]). Inspection of various aerial photos led to the conclusion that plant area was dependent on a number of factors including cooling system type, the extent of on-site coal storage, waste management practices, and the method of fuel delivery, among others. However, by excluding outliers, and plotting data from over 40 relatively large capacity coal burners, it was determined that typically large coal burning generating stations have land area requirements in the range of 0.5 to 1 ac/MW(e) (net).

Applying this result to a coal-fired replacement for VEGP (2,301 MW[e] net) results in land requirements in the range of 1,150 to 2,300 acres. In their Environmental Report, SNC estimated that about 800 acres would be needed at the VEGP site to accommodate a coal fired alternate. Given that some of the existing infrastructure at VEGP could be used to support operations of a coal fired complex, (cooling tower system, switch yard, offices, transmission lines, etc.), the 800 acre estimate by SNC is generally consistent with the lower limit of spatial requirements derived by the NRC staff. Thus, for the present analysis, it will be assumed that land requirements for a coal fired alternate at the VEGP site are approximately 800 acres and at an alternate site about 1,150 acres would be needed (based on the staff's lower limit).

In the GEIS, the NRC staff estimated that supplying coal to a 1,000 MW(e) plant would disturb approximately 22,000 acres (8,900 hectare [ha]) of land for mining the coal and disposing of the wastes during the 40-year operational life. A coal-fired alternative to replace VEGP (a 2,301 MW[e] capacity plant) would thus require approximately 47,380 acres (19,138 ha) of land. Coal mining would likely take place in existing coal-mining regions and in accordance with applicable mining regulations. In the GEIS, the NRC staff estimated that approximately 2,300 acres would be affected by the mining and processing of uranium over the operating life of a plant with VEGP's capacity.

Overall, when consideration is given to the extent of land disturbance associated with both power plant site development and coal mining operations, the NRC staff concludes that impacts to land use of developing a coal-fired alternate to VEGP would be MODERATE if the development occurs at the VEGP site, and MODERATE to LARGE if the development occurs at an alternate site.

- Ecology

Locating a coal-fired plant at the VEGP site would affect terrestrial ecological resources since much of the area available for development is covered with secondary growth forest (possibly tree plantations) and old field growth. Also several streams with abutting wetlands meander across the site. However, the undeveloped portions of the VEGP site are not unique in terms of vegetative cover or stream habitat within the larger Savannah River drainage basin. Development of a three unit coal burning facility at the site that utilizes existing infrastructure to the maximum extent practicable is expected to generate terrestrial ecological impacts that are best characterized as MODERATE. At an alternate site, the need to clear land for a transmission line and potentially a rail corridor would increase the scale of terrestrial impacts. At an alternate site the NRC staff characterizes development of a coal fired replacement for VEGP as having MODERATE to LARGE impacts depending on the length of transmission and rail corridors required.

Aquatic impacts of a supercritical coal-fired alternative would likely be similar to impacts of the existing VEGP, facility as the on-site option could make use of the existing cooling, intake and outflow structures. The improved heat rate of the coal-fired alternative compared to the existing nuclear facility means that less cooling water would be withdrawn from the Savannah River and blowdown flows back to the River would also be reduced. Based on the staff's finding that continued operation of the existing VEGP unit would result in SMALL impacts to aquatic ecology, it is reasonable to conclude the supercritical coal-fired option would also result in SMALL aquatic ecology impacts. A coal plant at an alternate site would likely also make use of cooling towers, and would incur similar aquatic impacts, which would range from SMALL to MODERATE, depending on characteristics of the water body used for cooling makeup.

- Water Use and Quality

Surface Water. NRC staff assumes that the coal-fired alternate at the VEGP site would use cooling towers for condenser cooling (possibly re-using the existing towers) and rely on the Savannah River for makeup. Given the improved heat rate of the supercritical alternative, it would require less cooling makeup than the existing nuclear plant and blowdown flows to the Savannah would also be reduced. Surface-water impacts would be SMALL, and slightly smaller than the proposed action.

The supercritical coal-fired alternative at an alternate site would likely use a closed-cycle cooling system with cooling towers. For alternate sites, impacts to surface waters would depend on the volume of water needed for makeup and the characteristics of the water body from which water is withdrawn. Intake from and discharge to any surface body of water would be regulated by the Georgia Department of Natural Resources (GDNR), Watershed Protection Branch. These impacts would range from SMALL to MODERATE.

Groundwater. VEGP currently uses approximately 1.05 mgd of groundwater for a variety of plant services and a coal-fired alternative on the VEGP site would likely continue to rely on groundwater for various auxiliary services. On site management of coal piles and coal wastes could, however, have an impact on groundwater resources should runoff from these materials storage and disposal facilities result in discharges of contaminants to groundwater. NRC staff expects, however, that runoff and other potential discharges from on-site coal operations would be regulated by GDNR in a manner similar to regulation of discharges to surface waters. Consequently, impacts of a coal-fired alternative at the VEGP site are expected to be SMALL.

At an alternate site, impacts to groundwater would depend on the extent to which the plant would utilize groundwater. NRC considers it unlikely that a coal-fired plant would depend on groundwater for cooling purposes and would likely use groundwater for only domestic and other auxiliary purposes. Consequently, the impact to groundwater resources at an alternate could be SMALL to MODERATE, depending on the nature of the aquifers occurring there.

- Air Quality

The air-quality impacts of coal-fired generation can be substantial and include emissions of sulfur oxides (SO_X), nitrogen oxides (NO_X), particulates, carbon monoxide (CO), hazardous air pollutants such as mercury, and naturally occurring radioactive materials. Many of these pollutants, however, can be effectively controlled by various technologies.

Burke County, and the entire Augusta-Aiken Air Quality Control Region within which the county is situated, meets the National Ambient Air Quality Standards established by U.S. Environmental Protective Agency (EPA) under the CAA (42 United States Code [USC] 7491). A new coal-fired generating plant developed at the VEGP site would need to comply with the new source performance standards for coal-fired plants set forth in 40 CFR 60 Subpart D(a). The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NO_X (40 CFR 60.44(a)). A coal-fired power plant constructed elsewhere in Georgia would need to comply with applicable provisions of the CAA, as well, based on the attainment status of the selected alternate site.

Section 169A of the CAA (42 USC 7401) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. EPA issued a new regional haze rule in 1999 (64 Federal Register [FR] 35714: EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a coal-fired plant were located close to a mandatory Class I area, additional air pollution control requirements would be imposed. Georgia has three designated Class I wilderness areas and South Carolina has one:

Table 8-3. Class I Areas in Georgia and South Carolina

State	Class I Area	Size (acres)	Distance to VEGP (miles)
Georgia	Cohutta Wilderness	40,000	190
Georgia	Okefenokee Wilderness	343, 776	146
Georgia	Wolf Island Wilderness	5,126	125
South Carolina	Cape Romaine Wilderness	28,000	119

A coal-fired alternate located at the VEGP site would not likely impact visibility at any Class I areas since the nearest such area, as can be noted from Table 8.3 above, is approximately 119 miles from VEGP. For an alternate site, consideration may have to be given to installation of addition air emission control systems if that site were in proximity to any Class I areas. In addition to regulating under the regional haze rule, EPA also regulates visibility, in general, pursuant to rules at 40 CFR 51, Subpart P.

The State of Georgia regulates air emissions from steam electric utility boilers pursuant to terms of the Georgia Air Quality Act (Part I of Chapter 9 of Title 12 of the Official Code of Georgia Annotated [O.C.G.A. Section 12-9-1, et seq.]). Regulations issued by GDNR (Chapter 391-3-1) adopt the EPA's CAA rules, with modifications, to limit power plant emissions of SO_X, NO_X, particulate matter, and hazardous air pollutants, among other matters. Depending where a new coal-fired facility is located within the State that facility will need to comply with the applicable Federal and State air regulations.

The supercritical coal-fired alternative would produce the following quantities of air pollutants:

<u>Sulfur oxides emissions</u>. This coal-fired alternative at the VEGP site would likely use wet, lime-based scrubbers to remove SO_X. EPA indicates that this technology can remove more than 95 percent of SO_X from flue gases (EPA 2002). NRC staff projects total SO_X emissions would be 5,600 tons per year.

SO_X emissions from a new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of sulfur dioxide (SO_2) and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, provided a new coal-fired power plant is able to purchase sufficient allowances to operate, it would not add to net regional SO_2 emissions, although it might do so locally.

Nitrogen oxides emissions. A coal fired alternate at the VEGP site would most likely employ various available NO_x-control technologies including low-NO_x burners, over-fire air, and selective catalytic reduction. EPA notes that when these emissions controls are used in concert, they can reduce NO_x emissions by up to 95 percent (EPA 1998a). Assuming the use of such technologies at VEGP site, NO_x emissions are estimated to be in the range of 1,820 tons annually.

Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants as indicated in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453; EPA 1998b), limits the discharge of any gases that contain nitrogen oxides (NO_2) to 200 nanograms (ng) per joule (J) of gross energy output (equivalent to 1.6 pound [lb]/megawatt hours [MWh]), based on a 30-day rolling average. NRC staff estimates that the total annual NO_x emissions for a new coal-fired power plant would be approximately 12.5 percent of the new source performance standard mission rate.

EPA further restricts the total amount of NO_x that can be emitted on a State level basis. In the 2008 ozone season (May 1–September 30) Georgia may emit 188,572 tons of NO_x. A new coal-fired power plant would need to offset emissions through credit purchases or from a set-aside pool.

Particulate emissions. This new coal-fired power plant would use fabric filters or electrostatic precipitators to remove particulates from flue gases. SNC indicates that fabric filters would remove 99.9 percent of particulate matter (SNC 2007a). EPA notes that filters or precipitators are each capable of removing in excess of 99 percent of particulate matter, and that SO_2 scrubbers further reduce particulate matter emissions (EPA 2002). As such, NRC staff believes SNC's removal factor is appropriate. Based on this, the new supercritical coal-fired plant would emit 320 tons of total suspended particulates and approximately 73 tons of particulate matter having an aerodynamic diameter less than or equal to 10 microns (PM_{10}) annually. In addition, coal burning would also result in approximately 0.3 tons of particulate emissions with an aerodynamic diameter of 2.5 microns ($PM_{2.5}$) and coal-handling equipment would introduce fugitive dust emissions when fuel is being transferred to on-site storage and then reclaimed from storage for use in the plant.

During the construction of a coal-fired plant, on-site activities would also generate fugitive dust. In addition, vehicles and motorized equipment would create exhaust emissions during the construction process. These impacts would be intermittent and short-lived, however. In addition, to minimize dust generation, construction crews would use applicable dust-control measures.

Carbon monoxide emissions. Based on EPA emission factors (EPA 1998a), NRC staff estimates that the total CO emissions would be approximately 1,820 tons per year.

Hazardous air pollutants including mercury. In December 2000, EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000b). EPA concluded that mercury is the hazardous air pollutant of greatest concern. EPA found that (1) there is a link between coal consumption and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000b). Accordingly, on March 15, 2005, EPA issued the Clean Air Mercury Rule to permanently cap and reduce mercury emissions from coal-fired power plants (EPA 2007). A new coal-fired power plant would need to comply with performance standards contained in 40 CFR 60.45(a), requiring that the plant emit no more than 0.0025 ng/J output (20×10^{-6} lbs /MWh). In addition, to the extent the plant would emit any mercury, the plant owners would need to purchase mercury allowances or reduce emissions to ensure that Georgia emits no more than 1.166 tons of mercury containing gases in 2010, and 0.460 tons of mercury containing gases in 2018 (EPA 2006).

Uranium and thorium. Coal contains uranium and thorium, among other naturally occurring elements. Alex Gabbard, a researcher at Oak Ridge National Laboratory, indicates that uranium concentrations are generally in the range of one to ten parts per million (ppm) and thorium concentrations are generally about two and a half times this level (Gabbard 1993). The U.S. Geological Survey (USGS) indicates that Western and Illinois Basin coals contain uranium and thorium at roughly equal concentrations, mostly between 1 and 4 ppm, but also indicates that some coals may contain concentrations as high as 20 ppm of both elements (USGS 1997). Gabbard indicates that a 1,000 MW(e) coal-fired plant would release roughly

5.2 tons of uranium and 12.8 tons of thorium annually (Gabbard 1993). Both USGS and Gabbard indicate that almost all of the uranium, thorium, and most decay products remain in solid coal wastes, especially in the fine glass spheres that constitute much of coal's fly ash. Modern emissions controls, such as those included for this coal-fired alternative, allow for recovery of greater than 99 percent of these solid wastes (EPA 2002), thus retaining most of coal's radioactive elements in solid form rather than releasing it to the atmosphere. Even after concentration in coal waste, the level of radioactive elements remains relatively low (typically 10 to 100 ppm) and consistent with levels found in naturally occurring granites, shales, and phosphate rocks (USGS 1997). The level of uranium and thorium contained in coal wastes and disposed of in the environment exceed the levels of uranium and thorium released to the environment by the existing nuclear power plant.

Carbon dioxide. A coal-fired plant would also have unregulated carbon dioxide (CO_2) emissions during operations as well as during coal mining and processing, and coal and lime transportation. Burning bituminous coal in the U.S. emits roughly 205.3 lbs CO_2 per million BTU (Hong and Slatick 1994). The supercritical coal-fired plant would emit approximately 20 million tons of CO_2 per year.

Summary of air quality. While the GEIS analysis mentions global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts, it did not quantify emissions from coal fired power plants. However, the GEIS analysis did imply that air impacts would be substantial (NRC 1996). The above analysis shows that emissions of air pollutants, including SO_X, NO_X, carbon monoxide, and particulates, exceed those produced by the existing nuclear power plant, as well as those of the other alternatives considered in this section. Operational emissions of carbon dioxide are also much greater under the coal-fired alternative.[e]

Adverse human health effects such as cancer and emphysema have also been associated with air emissions from coal combustion. NRC analysis for a coal-fired alternative at the VEGP site and an alternative site indicates that impacts from the coal-fired alternative would have clearly noticeable effects, but given existing regulatory regimes, permit requirements, and emissions controls, the coal-fired alternative would not destabilize air quality. Thus, the appropriate characterization of air impacts from coal-fired generation would be MODERATE. Siting a coal-fired generation plant at a site other than VEGP would not significantly change air-quality impacts, although it would result in installing more- or less-stringent pollution-control equipment to meet applicable local requirements, or cause the plant's owner to more- or less-actively participate in various emissions trading schemes. Impacts to air quality at an alternate site would also be MODERATE.

(e) Table S-3 in 10 CFR 51.51 indicates that electrical energy consumed during the uranium fuel cycle to supply a 1,000 MW(e) is equivalent to the electricity produced by a 45 MW(e) coal-fired power plant.

- Waste

Coal combustion generates several waste streams including ash (a dry solid) and sludge (a semi-solid by-product of emission control system operation). The NRC staff estimates that three 767 net MW(e) coal-fired units would generate approximately 640,000 tons of ash and 304,000 tons of sludge each year. This estimate is based on data provided by SNC in the Environmental Report with appropriate scaling applied to the SNC estimates to account for assumed differences in plant heat rates and net electrical output. Of this waste, approximately 90 percent of the ash could be recycled according to SNC with the remainder being disposed in an on-site land fill. On-site disposal is likely to encompass approximately 220 acres of the VEGP site over 40 years of operation. As mentioned in the air quality section, this waste would also contain levels of uranium and thorium in concentrations similar to those found in naturally occurring granites, shales, and phosphate rocks (USGS 1997). In addition to coal combustion wastes, a supercritical coal-fired alternative would also produce small amounts of domestic and hazardous wastes.

Waste impacts to groundwater and surface water would extend beyond the operating life of the plant if leaching and runoff from the waste storage area makes its way into groundwater or surface water. Disposal of the waste would noticeably affect land use and groundwater quality if not properly managed, but with appropriate management and monitoring, effects on groundwater water resources would be prevented. After closure of the landfill and re-vegetation, the disposal area would be available for other uses. Impacts of the waste generated by a coal fired alternative are considered by the NRC staff to be SMALL to MODERATE.

Considerable debris would be generated during construction of three coal units to replace VEGP. Most of such waste material would be disposed or recycled off-site though some could be land filled on-site as well. Overall, the mass of waste generated during construction would be small compared to the quantity generated during operation of the coal burning replacement and, as such, impacts of construction-stage waste would be SMALL. For all of the preceding reasons, the appropriate characterization of impacts from waste generated by the supercritical coal-fired alternative would be MODERATE; the impacts would be clearly noticeable, but would not destabilize any important resource. Siting the facility at a site other than VEGP would not alter waste generation, although alternate sites could pose unique waste disposal constraints. Overall, the NRC staff considers waste impacts at an alternate site to also be MODERATE.

- Human Health

Coal-fired power generation introduces worker risks from coal and limestone mining, from coal and lime transportation, and from disposal of coal combustion waste. In addition there are public risks from inhalation of stack emissions. Emission impacts can be widespread and health risks difficult to quantify. The coal-fired alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

Regulatory agencies, including EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, EPA has concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants and has taken action to address mercury emissions from coal-fired power plants. In the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal would be characterized as SMALL.

- Socioeconomics

Construction of the supercritical coal-fired alternative would take approximately 5 to 6 years (DOE/EIA 2007c). The NRC staff assumed that construction would take place while VEGP continues operation and would be completed by the time the two units permanently cease operations in 2027 and 2029. The construction work force would be expected to include up to 2,000 workers at peak times (NRC 1996). These workers would be in addition to the approximately 862 workers currently employed at VEGP. During construction, the surrounding communities could experience an increased demand for rental housing and public services, though this would be moderated by the relative proximity of the site to Augusta/Aiken. After construction, communities that provided housing and other support during construction would be somewhat affected by loss of the temporary construction-related activity.

If the coal-fired replacement plant were constructed at the VEGP site, and VEGP were to be decommissioned, the area would experience a loss of approximately 488 permanent, relatively high-paying jobs (from 862 employees for VEGP to about 400 for the coal-fired plant) with a commensurate reduction in purchasing activity and tax contributions to the regional economy. The impact of the job loss is, however, expected to be SMALL given the relatively large area from which plant personnel are currently drawn and the extensive timeframe over which construction of a new plant and decommissioning of the existing facility would occur. The coal-fired plant would provide a new tax base in Burke County to offset the loss of taxes that would occur when VEGP is decommissioned. While it is difficult to estimate the impact of this scenario on Burke County resources, it would not be unreasonable to assume that, on balance, the County's tax base would not be significantly altered and that resulting impacts could be best characterized as being SMALL to MODERATE.

The magnitude of socioeconomic impacts would vary at an alternate site depending on location. During peak construction, there could be up to 2,000 workers at the site, and surrounding communities would experience increased demands on rental housing and public services that could result in SMALL to MODERATE impacts. Upon completion of the new coal-fired power plant, host communities would be affected by the loss of construction jobs but would be offset by approximately 400 new long-term operations jobs at the new plant. Overall, operational impacts could range from SMALL to LARGE, socioeconomic impacts would be greater (up to LARGE) if the new coal-fired power plant were constructed at a rural location rather than if it were constructed in a more developed urban site.

There would also be a noticeable impact on Burke County due to the loss of jobs and tax revenues should VEGP cease operations and no replacement power plant was built at VEGP. Since Burke County currently relies on VEGP for approximately 75 percent of its tax revenue, the loss of that revenue could represent a MODERATE to LARGE socioeconomic impact if the coal-fired power plant were to be constructed at an alternate site.

- Socioeconomics (Transportation)

During the four to five-year construction period of replacement coal-fired units, up to 2,000 construction workers would be commuting to the VEGP site in addition to the current 862 workers already at VEGP. The addition of these workers would increase traffic loads on existing highways and, particularly, on local roads leading to the plant site. Given the limited number of access points to the site, transportation impacts associated with commuting construction workers would likely be in the range of SMALL to MODERATE. Transportation-related impacts associated with commuting construction workers at an alternate site are site dependent and characterized as being in the range of SMALL to LARGE.

Transportation impacts of commuting plant operating personnel are expected to be SMALL. The number of operations personnel working at a coal-fired power plant would be approximately 400 compared to the current VEGP work force of 862. At an alternate site it is expected approximately 400 operating personnel commuting to the power plant would not likely overload nearby access roadways.

Approximately 1 to 2 unit trains per day (each with 100 cars carrying 100 tons of fuel) would deliver coal to the new plant at the VEGP site. Since each train load generates an empty return load, the number of movements per day along the rail spur to the VEGP site would actually be 2 to 4 trains per day. The rail line leading to the site crosses a number of local roadways and extensive delays could be experienced by waiting for trains to clear grade crossings. Consequently, rail transportation impacts of coal and lime delivery to the VEGP site are expected to be SMALL to MODERATE. At an alternate site, coal and lime would be delivered by rail and transportation impacts could range from SMALL to LARGE depending on site location and other characteristics.

- Aesthetics

If constructed and operated at the VEGP, the coal-fired units would have boiler houses rising about 200 feet above ground level; these would not be particularly visible from significant distances offsite due to the undulating terrain and the considerable tree plantation farming in the plant vicinity. The three exhaust stacks of the coal-fired units would rise about 500 feet above grade high and would be visible for a considerable distance offsite. Given the current presence of cooling towers and their vapor plumes, as well as other on-site plant structures, the addition of power plant stacks to the visual setting would not drastically increase visual impacts there. The coal-fired units would also be visible at night because of mandated safety lighting on the stacks and along the plant perimeter. Overall, construction and operation of three coal-fired units at the VEGP site would likely result in a SMALL to MODERATE aesthetic impacts.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite, although given the low population near the plant's periphery, nuisance impacts are not expected. Sources contributing to total noise produced by plant operation would be classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime delivery, use of outside loudspeakers, and the commuting of plant employees. The nuisance impacts of plant noise emissions are expected to be SMALL due to the large area encompassed by the VEGP site and the fact that few sensitive land sues occur in the immediate plant vicinity.

Noise impacts associated with rail delivery of coal and lime to a coal fired facility at VEGP would be most significant for residents living along the 20 mile rail corridor that leads to the plant site. Depending on ambient noise levels and the number of coal deliveries occurring at night, it is possible that rail related noise impacts (including sounding of safety horns at grade crossings) would range from SMALL to MODERATE.

At an alternate site, plant buildings, exhaust stacks, cooling towers, and cooling tower plumes would create aesthetic impacts. There would also be an aesthetic impact associated with construction of a new transmission line. Noise and light from the plant could be detectable offsite depending on site characteristics. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other power plants or industrial facilities. Noise impacts from offsite rail operations could encompass a wide range of impacts also depending on site characteristics. Overall the aesthetic impacts associated with locating at an alternate site would be categorized as SMALL to LARGE, with impacts potentially being less at a previously developed industrial site.

- Historic and Archaeological Resources

At the VEGP site or an alternate site, a cultural resource inventory would be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the coal-fired alternate would also need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before beginning construction at an alternate site, surveys would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs).

Historic and archaeological resource impacts can generally be effectively managed and as such would be considered SMALL for the existing site and likely SMALL to MODERATE at a new site. For a previously developed site, most of which would have already been intensively developed, the impact on cultural and historic resources would also be SMALL. Previous development would likely have either removed or surveyed items of archaeological interest.

- Environmental Justice

No environmental impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the VEGP site. Some impacts on rental and other temporary housing availability and lease prices during construction might occur, and this could disproportionately affect the minority and low-income populations.

Impacts on minority and low-income populations due to the shutdown of VEGP would depend on the number of jobs and the amount of tax revenue lost by Burke County and the communities surrounding the power plant. Closure of VEGP would eliminate jobs and reduce tax revenue in the region that were directly and indirectly attributed to plant operations. However, given the economic growth of Columbia County and the Augusta area, it is likely that these losses could be replaced by the development of new businesses and new sources of tax revenue in the region. Since SNC's tax payments represent a large percentage of Burke County's total annual property tax revenue, it is likely that social services in Burke County would be seriously affected. Therefore, minority and low-income populations in Burke County could experience disproportionately high and adverse socioeconomic impacts from the shutdown of VEGP.

The shutdown of VEGP would reduce operational impacts on the environment. Therefore, minority and low-income populations in the vicinity of VEGP would not likely experience any disproportionately high and adverse environmental impacts from the shutdown of VEGP. The impact of constructing a new coal-fired power plant at an alternative site would depend on its location in relation to minority and low-income populations. Environmental and economic impacts could range from SMALL to LARGE. Impacts could be larger at previously undeveloped sites, depending on its proximity to minority and low-income populations.

8.2.2 Coal Based Integrated Gasification Combined-Cycle (IGCC) Generation

The second coal based option considered by NRC as an alternative to VEGP license renewal is an IGCC plant. In both concept and practice, IGCC plants can be fueled with a variety of feedstock, and large IGCC plants are often fueled by byproducts of petroleum refining. For the purpose of this analysis, it assumed that an IGCC replacement for VEGP would be a stand-alone facility and would not be co-located at a refinery; therefore, only IGCC plants using coal as the primary fuel are considered.

Coal based IGCC plants operate very differently from conventional coal plants, and were not considered by NRC staff in the GEIS. A coal IGCC plant first heats coal in a gasifier with carefully controlled amounts of water and oxygen. The resulting gas stream (called synthesis gas or syngas) contains primarily carbon monoxide and hydrogen. Most coal impurities remain in gasifier waste material, called slag, while gasifiers convert sulfur-containing compounds to either elemental sulfur or sulfuric acid, both of which can be marketed as commodities. Gaseous pollutants, mercury among them, can be removed from the syngas stream prior to combustion. Following gasification and pollutant removal, the gas stream travels to a conventional combined-cycle power plant, similar in construction to a natural-gas-fired combined-cycle power plant. First, the gas stream burns in a combustion turbine. Then, the still-hot gas mixture gives up most of the remaining heat to water in a heat recovery steam generator.

While IGCC plants can theoretically achieve thermal efficiencies approaching 50 percent (DOE/EIA 2005), the technology is still relatively young from a utility-scale commercial perspective, and actual efficiencies tend to be on the order of 40 percent (Ekbom 2007). No IGCC plant with a capacity as large as VEGP has yet been constructed. The largest IGCC plant is the ATI Sulcis plant in Portoscuso, Italy, which has a net output of 471 MW(e) (roughly 20 percent of VEGP's net capacity of 2,301 MW[e]). The largest IGCC plant in the U.S. is the Wabash River plant in Terre Haute, IN, with a net capacity of 262 MW(e) (11 percent of VEGP's net capacity). A 603 MW(e) net output plant, equivalent to 26 percent of VEGP's capacity, is proposed for completion in the Mesaba Iron Range in Minnesota by 2011, and regulator approval was recently granted for the construction of a 630 MW(e) net capacity plant in Edwardsport, Indiana (WSJ 2007).

Despite the lack of IGCC plants of similar capacity to VEGP, NRC staff notes considerable utility interest in this technology for its ability to effectively reduce emissions of many air pollutants as well as to potentially produce a separate carbon dioxide stream for eventual sequestration. Given IGCC's limited commercial implementation in the U.S., EPA has not yet developed detailed emissions factors for the technology. In general, NRC staff has adopted emissions factors from DOE (DOE 1999) in order to characterize emissions from the IGCC alternative. DOE/EIA adopted a heat rate of 8,309 BTU/kWh for coal-fueled IGCC alternatives for forecasting purposes (DOE/EIA 2005), and NRC staff will adopt EIA's assumed heat rate for this analysis, as it closely approximates data from existing IGCC plants (e.g., Tampa Electric Company's Polk Plant and the Wabash River Coal Gasification Repowering Project; DOE 2004 and 2004). The analysis also assumes 10% onsite power consumption; this level of onsite consumption is consistent with experience at the Wabash River site (DOE 2000). Therefore, a coal IGCC replacement alternative for VEGP would require a total gross output rating of 2,560 MW(e). For the purpose of this analysis, it is assumed that VEGP would be replaced by 4 generating stations, each with a net capacity of 640 MW(e). This reflects a modest increase of only 2 percent beyond the largest currently proposed IGCC installation, and is therefore considered technically feasible. A capacity factor of 0.85, as used by SNC and adopted by NRC for its analysis of the supercritical coal-fired alternative, is also used for the IGCC alternative. It should also be noted that the prediction of 10% onsite power consumption is reflective of the power needs for the basic technology. Advanced options, such as the addition of processes to sequester carbon emissions, can increase onsite power requirements to as much as 30 percent of the gross capacity. As there is no current regulatory framework regulating carbon emissions, carbon sequestration is not considered in this analysis.

Although the operating license renewal period is only 20 years, NRC staff analyzed the impact of operating the coal IGCC alternative for 40 years, as this may be a reasonable projection of the operating life of an IGCC plant and is consistent with the analysis NRC staff conducted for the supercritical coal-fired alternative.

Volumes of feedstock and waste product for the IGCC alternative were calculated by NRC staff on the basis of the gross MW(e) rating of the replacement plant, using average heat, sulfur and ash contents of coal delivered to Georgia for electric generation. These calculations assumed an average heat value of 11,058 BTU/lb, and average sulfur and ash contents of 0.81 and 8.83 percent by weight, respectively (DOE/EIA 2007b). On this basis, NRC estimates that an IGCC plant with a gross output of 2,560 MW(e) would consume approximately 6.51 million metric tones (MT) (7.15 million tons) of bituminous coal per year, and produce approximately 575,000 MT (631,500 tons) of slag and 52,750 MT (57,900 tons) of elemental sulfur in a year. SNC indicated in the Environmental Report that both slag and sulfur are considered marketable commodities, although no estimation of the percentage of these waste streams that might be saleable was provided. Slag has several reuse opportunities, including in concrete and asphalt aggregate, as backfill material, and as landfill daily cover. Historically, the primary technical obstacle to the beneficial reuse of slag has been excessive carbon content. However, technologies to recover and recycle unconverted carbon are now feasible, resulting in a slag waste stream that is consistently of saleable quality (Ratafia-Brown et al. 2002). Depending on the specific process installed, sulfur is recovered from the IGCC power generation as either elemental sulfur or sulfuric acid. The elemental sulfur is typically about 99.99 percent pure, while the sulfuric acid is generally about 98 percent pure (Rosenberg et al. 2004). These products are both valuable commodities that can be employed in numerous industries, including fertilizer manufacture and wastewater treatment. The Environmental Report also notes IGCC's ability to remove wastes prior to syngas combustion (SNC 2007a). As such, it is expected that no additional scrubbing of the exhaust stream would be necessary.

At the VEGP site, coal would likely be delivered by rail, while slag and sulfur for reuse would likely be removed by rail or by truck. The IGCC coal fired option would likely require approximately 615 unit trains (100 car consists) per year, or roughly 14 round trips per week. As noted in the Environmental Report (SNC 2007a), it is expected that the existing rail spur would need to be improved to allow for these deliveries. For purposes of this section, the NRC staff assumed that a coal IGCC plant located at either the VEGP site or an alternate site would use a closed-cycle cooling system, as the current VEGP units do.

The NRC staff discusses the overall impacts of the coal IGCC generating system in the following sections and summarizes the analysis in Table 8-4. The extent of impacts at an alternate site would depend on the location of the particular site selected.

- Land Use

  The existing facilities and infrastructure at the VEGP site would be used to the extent practicable, limiting the amount of new construction. A new coal IGCC plant may be able to use the existing cooling tower system, switchyard, offices, and transmission line. Much of the land that would be used has been previously disturbed. As noted in Section 8.2.1 improvements to the existing rail line that leads to the VEGP site would be needed to support coal based operations.

  While the power block of an IGCC complex may be somewhat larger than that of a comparable capacity pulverized coal complex, land needs for on-site waste disposal can be considerably less since most IGCC by-products can be marketed. Overall, the staff views its land area estimates for pulverized coal facilities to be generally applicable to the land requirements for IGCC. It is, therefore, the staff's view that land requirements estimated for pulverized coal burning at the VEGP site (800 acres) and at an alternate site (1,150 acres) are also applicable to the IGCC alternate.

  Additional land-use changes would occur in an undetermined coal-mining area from which coal would be shipped to the plant. Assuming a mix of coal supply similar to Georgia's current coal supply, this land disturbance would likely occur mostly in Kentucky and Wyoming, with disturbance occurring to a lesser degree in Virginia as well (DOE/EIA 2007b). Based on analyses presented in the GEIS, an IGCC alternative to replace VEGP would require approximately 49,450 acres (20,470 ha) of land. Coal mining would likely take place in existing coal-mining regions and in accordance with applicable mining regulations. Based on analyses presented in the GEIS, it is estimated that approximately 2,560 acres (1,025 ha) would be affected for mining the uranium and processing it during the operating life of a 2,301 MW(e) nuclear power plant.

The impacts of an IGCC complex, developed at the VEGP site, could to be MODERATE An IGCC alternative at an alternate site could also generate MODERATE to LARGE land use impacts.

- Ecology

Locating a coal IGCC plant at the VEGP site would affect terrestrial ecological resources since much of the available land is currently used as tree plantation and some undeveloped portions of the VEGP site support wetland and stream habitats. As a result, the staff estimates terrestrial ecological impacts of developing and IGCC complex at the VEGP site to be MODERATE. At an alternate site, clearing land for transmission lines and possibly a rail spur would be needed in addition to land for plant facilities and infrastructure. The scale of land use impacts associated with developing and IGCC complex at an alternate site are, therefore, considered to be in the range of MODERATE to LARGE.

It is expected that an IGCC complex constructed at the VEGP site would operate with cooling towers, as does the existing VEGP facility. Aquatic ecological impacts of an IGCC complex at the VEGP site would be approximately the same as those generated by the existing nuclear facility even though IGCC production is probably more thermally efficient than a nuclear plant (i.e., for the same gross electrical output an IGCC alternative will reject less heat to the environment than would a nuclear plant). The improved thermal efficiency is, however, balanced somewhat by an increased demand for on-site power by the IGCC facility. Since aquatic ecological impacts of the existing VEGP facility, which are a result of water withdrawals for cooling tower makeup, have been determined to be SMALL, the IGCC alternate will also have SMALL aquatic impacts. An IGCC facility at an alternate site would also make use of cooling towers, and would incur aquatic impacts that would range from SMALL to MODERATE, depending on characteristics of the water body used for cooling.

Table 8-4. Summary of Environmental Impacts of Coal IGCC Generation at VEGP Site and an Alternate Site Using Closed-Cycle Cooling

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land Use	MODERATE	Uses approximately 800 additional on-site acres; additional offsite land impacts for coal mining affects thousands of acres.	MODERATE to LARGE	Uses approximately 1150 acres for plant, offices, parking, and potential waste disposal; additional impacts from transmission line, and rail spur, as well as coal mining
Ecology	MODERATE	Uses undeveloped areas at current VEGP site, plus existing rail and transmission corridors; impacts also dependent on lands used for coal mining.	MODERATE to LARGE	Impact depends on location and ecological value of site, surface water body used for intake and discharge, and transmission line and rail routes; may cause habitat loss and fragmentation, as well as reduced productivity and biological diversity; impact also dependent on coal mining.
Water Use and Quality—Surface Water	SMALL	Uses existing cooling tower system, and potentially less water than the existing VEGP.	SMALL to MODERATE	Closed-cycle cooling, impact likely to be SMALL, though it would depend on the volume of water withdrawn and discharged, as well as the characteristics of the surface water body.
Water Use and Quality—Groundwater	SMALL	IGCC complex would likely continue to rely on groundwater for only miscellaneous plant services.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the aquifers, though groundwater would not likely be used for cooling tower makeup purposes.

Table 8-4. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Air Quality	MODERATE	• Sulfur oxides (1,344 tons/yr) • Nitrogen oxides (1,898 tons/yr) • PM_{10} (158 tons/yr) • Carbon monoxide (2,370 tons/yr) • Mercury removed by syngas-stage controls	MODERATE	Potentially the same impacts as at the VEGP site, although pollution-control requirements may vary.
Waste	SMALL	It is expected that most byproducts from an IGCC alternative would be saleable commodities, and minimal (if any) on-site disposal would be required.	SMALL	Same impacts as at the VEGP site; waste disposal constraints may vary.
Human Health	SMALL	Impacts are uncertain, but considered SMALL as the plant would comply with health-informed standards in the Clean Air Act and other relevant emissions regulations.	SMALL	Similar impacts as at the VEGP site.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 2,000 workers during the peak period of the 5- to 6-year construction period, followed by an as-yet unspecified reduction from current VEGP work force of 862. Tax base would be preserved in Burke County. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts depend on location, but would be LARGE if the plant is located in an area that is rural or is growing less quickly than areas near the VEGP site. Impacts at a site near to an urban area may be SMALL to MODERATE.

Table 8-4. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts would be SMALL to MODERATE during the construction phase. For rail transportation of coal and waste products, the impacts would likely be MODERATE as a result of rail delivery impacts.	SMALL to LARGE	Transportation impacts would be SMALL to LARGE due to construction activities. For rail transportation of coal, the impact would be SMALL to LARGE and depend on routing of coal trains.
Aesthetics	SMALL to MODERATE	Aesthetic impact due to plant units and stacks would be SMALL. Rail transportation of coal would have a SMALL to MODERATE aesthetic impact. Noise impact would be SMALL given the size of the site.	SMALL to LARGE	Overall impacts could vary widely, with the greatest impacts from new transmission lines, rail lines to transport coal, and cooling towers.
Historic and Archeological Resources	SMALL	Most construction would affect previously developed parts of the VEGP site; a cultural resource inventory and mitigation measures would manage impacts on undeveloped areas.	SMALL to MODERATE	Alternate location would necessitate cultural resource studies; construction would likely avoid highly sensitive areas. Impacts would be managed.
Environmental Justice	SMALL	Impacts on minority and low-income communities would be similar to those experienced by the population as a whole. Some impacts on rental housing may occur during construction	SMALL to LARGE	Impacts would vary depending on population distribution and location of the alternate site. Significant impacts would occur in Burke County due to loss of tax base and jobs. Impacts to minority and low-income populations in Burke County would be due to lost tax revenue based services and jobs.

- Water Use and Quality

Surface Water. The IGCC alternate at the VEGP site would likely use the existing cooling tower system if at all practicable. Given that the IGCC would likely need to dissipate a similar level of thermal energy as the existing VEGP facility, as noted above, it would also utilize approximately the same quantity of cooling water as VEGP. As such, impacts to surface water use and water quality would be SMALL, should an IGCC complex operate the VEGP site.

At an alternate site, an IGCC complex would also likely be designed with closed cycle cooling and therefore, the impacts to surface waters would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the water body used for intake and discharge. Intake from and discharge to any surface body of water would be regulated by GDNR via various state-level discharge permit programs. The NRC staff considers the impacts to potentially range from SMALL to MODERATE.

Groundwater. VEGP uses an average of 1.05 mgd of groundwater drawn from on-site wells, and is permitted to draw up to 5.5 mgd on average. Groundwater is used at VEGP for nuclear service cooling water, utility service water, and makeup for the water treatment plant, fire protection system, and potable and sanitary water systems. As an IGCC alternative on the VEGP site would likely require approximately the same quantity of water for these auxiliary purposes, the impact to groundwater, of IGCC operations would be SMALL, as is the case for continued operation of the VEGP facility.

On-site management of coal piles and coal wastes (from IGCC operations) could, however, have an impact on groundwater resources should runoff from these materials storage and disposal facilities result in discharges of contaminants to groundwater. NRC staff expects, however, that runoff and other potential discharges from on-site coal operations would be regulated by GDNR in a manner similar to regulation of discharges to surface waters. Thus, NRC staff considers overall groundwater impacts of IGCC operations to be SMALL at the VEGP site.

At an alternate site, impacts to groundwater would depend on the extent to which the plant utilizes groundwater, though NRC finds it unlikely that an IGCC plant would depend on groundwater for cooling purposes. Given that a plant would likely use groundwater only for domestic and some service purposes, the impact could be SMALL to MODERATE, depending on the nature of the aquifers used.

- Air Quality

The air-quality impacts of coal IGCC generation can be substantial, though markedly less than conventional coal technologies in several important areas. These include lower emissions of mercury as well as particulate matter. Pre-scrubbed levels of SO_x and NO_x are also typically much lower than conventional coal technologies. In addition, naturally occurring radioactive materials would likely remain in slag much as they remain in solid ash products in conventional coal plants.

Burke County, and the entire Augusta-Aiken Air Quality Control Region within which the county is situated, meets the National Ambient Air Quality Standards established by EPA under the CAA (42 USC 7401). A new coal IGCC generating plant developed at the VEGP site would need to comply with the new source performance standards for coal-fired plants set forth in 40 CFR 60 Subpart D(a). The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)). A coal IGCC power plant constructed elsewhere in Georgia would need to comply with applicable provisions of the Clean Air Act, as well, based on the attainment status of the selected alternate site.

Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. EPA issued a new regional haze rule in 1999 (64 FR 35714; EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a coal-fired plant were located close to a mandatory Class I area, additional air pollution control requirements would be imposed. Georgia has three designated Class I wilderness areas and South Carolina has one.

A coal IGCC alternate located at the VEGP site would not likely impact visibility in any Class I areas since the nearest such area, as can be noted from Table 8.3, is approximately 119 miles from VEGP. For an alternate site, consideration may have to be given to installation of addition air emission control systems if that site were in proximity to any one of the Class I areas. In addition to the regional haze rule, EPA also regulates visibility, in general, pursuant to rules at 40 CFR 51, Subpart P.

The coal IGCC alternative would produce the following annual emissions of air pollutants:

Sulfur oxides emissions. DOE indicated that a coal IGCC plant would emit 0.0077 kilograms (kg) (0.017 lb) of SO_X per million BTU of thermal input (DOE 1999). Based on this emission rate, NRC staff projects total SO_X emissions are of 1,218 MT (1,344 tons) per year without any additional emissions control technology.

A new coal-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_X, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal IGCC power plant would not add to net regional SO_2 emissions, although it might do so locally.

Nitrogen oxides emissions. DOE indicated that a coal IGCC plant would emit 0.0109 kg (0.024 lb) of NO_X per million BTU of thermal input (DOE 1999). In the absence of additional control technologies, the IGCC alternative would produce 1,724 MT (1,898 tons) of NO_X per year, based on DOE emissions projections (DOE 1999).

Section 407 of the CAA establishes technology-based emission limitations for NO_X emissions. The market-based allowance system used for SO_2 emissions is not used for NO_X emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants as indicated in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453; EPA 1998b), limits the discharge of any gases that contain NO_2 in excess of 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average. NRC staff estimates that the total annual NO_X emissions for a new IGCC plant would be approximately 12.4 percent of the new source performance standard emission rate. This level of NO_X emissions would be greater, however, than the operating license renewal alternative.

EPA further restricts the total amount of NO_X that can be emitted on a State level basis. In the 2007 ozone season (May 1–September 30) Georgia may emit 171,285 MT (188,572 tons) of NO_X. A new coal IGCC power plant would need to offset emissions through credit purchases or from a set-aside pool.

Particulate emissions. Unlike SO_X and NO_X, where DOE has calculated approximate emission rates, DOE has indicated only that a coal IGCC plant would emit less than 0.001 kg (0.002 lb) of particulate matter per million BTU of thermal input (DOE 1999). Assuming the maximum particulate emissions rate, NRC staff estimates that the total annual stack emissions would include approximately 144 MT (158 tons) of filterable total suspended particulates, all of which have an aerodynamic diameter less than or equal to 10 microns (PM_{10}) (40 CFR 50.6). In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal IGCC alternative than the operating license renewal alternative.

During the construction of a coal IGCC plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process. These impacts are intermittent and short-lived. To minimize dust generation, construction crews would use applicable dust-control measures.

Carbon monoxide emissions. In the absence of DOE or EPA emissions data, a CO emissions rate of 0.03 lb/million BTU, previously used in the analysis of an IGCC alternative for a separate relicensing application (Progress Energy 2006) and adopted by NRC staff, is used. At that emissions rate, total carbon monoxide emissions would be approximately 2,153 MT (2,370 tons) per year. This level of emissions would be greater than the operating license renewal alternative.

Hazardous air pollutants including mercury. In December 2000, EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000b). EPA concluded that mercury is the hazardous air pollutant of greatest concern, and found that (1) there is a link between coal consumption and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000b). Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the Clean Air Act for which emission standards for hazardous air pollutants will be issued (EPA 2000b).

Also, on March 15, 2005, EPA issued the Clean Air Mercury Rule to permanently cap and reduce mercury emissions from coal-fired power plants (EPA 2007). A new coal IGCC power plant would need to comply with performance standards contained in 40 CFR

60.45(a), requiring that the plant emit no more than 0.0025 ng/J output (20 x 10^{-6} lbs/MWh). In addition, to the extent the plant would emit any mercury, the plant owners would need to purchase mercury allowances or reduce emissions to ensure that Georgia emits no more than 1.166 tons of mercury containing gases in 2010, and 0.460 tons of mercury containing gases in 2018 (EPA 2007). It should be noted that IGCC units minimize mercury emissions by allowing control technologies to extract mercury from syngas prior to combustion in the combined-cycle power plant.

Uranium and thorium. Coal contains uranium and thorium, among other naturally occurring elements. Alex Gabbard, a researcher at Oak Ridge National laboratory, indicates that uranium concentrations are generally in the range of 1 to 10 ppm and thorium concentrations are generally about 2.5 times this level (Gabbard 1993). The USGS indicates that Western and Illinois Basin coals contain uranium and thorium at roughly equal concentrations, mostly between 1 and 4 ppm, but also indicates that some coals may contain concentrations as high as 20 ppm of both elements (USGS 1997). Gabbard indicates that a 1,000 MW(e) coal-fired plant would release roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium annually (Gabbard 1993). Both USGS and Gabbard indicate that almost all of the uranium, thorium, and most decay products remain in solid coal wastes. In an IGCC plant, uranium and thorium would remain in slag material. Even after concentration in coal slag, the level of radioactive elements remains relatively low (typically 10 to 100 ppm) and consistent with levels found in naturally occurring granites, shales, and phosphate rocks (USGS 1997). The level of uranium and thorium contained in coal wastes and environmentally disposed exceeds the level of uranium and thorium released to the environment by continued operation of the VEGP facility.

Carbon dioxide. A coal IGCC plant would also have unregulated CO_2emissions during operations of the plant itself as well as during coal mining and processing, as well as coal transportation. Burning bituminous coal in the U.S. emits roughly 205.3 lbs CO_2 per million BTU (Hong and Slatick 1994). The alternative IGCC plant would emit approximately 16.2 million tons of CO_2 per year.

Summary of air quality impacts. While the GEIS analysis mentions global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts, it did not quantify emissions from coal fired power plants. However, the GEIS analysis did imply that air impacts would be substantial (NRC 1996). Adverse human health effects such as cancer and emphysema have been associated with the products of coal combustion. NRC staff analysis for a coal IGCC alternative at the VEGP site and an alternative site indicates that impacts from the IGCC alternative would have clearly noticeable effects, but would not destabilize air quality. Thus, the appropriate characterization of air impacts from IGCC operations would be MODERATE.

Siting an IGCC plant at a site other than VEGP would not significantly change air-quality impacts, although it would result in installing more or less stringent pollution-control equipment to meet applicable local requirements. Therefore, the impacts at an alternate site would also be MODERATE.

- Waste

IGCC combustion of coal generates waste as slag, a vitreous, sand-like material that must be handled in accordance with state and federal regulations. The IGCC alternative would generate 575,000 MT (631,500 tons) of slag and 52,750 MT (57,900 tons) of elemental sulfur in a year annually for 40 years. SNC considers these waste streams to be saleable commodities in the Environmental Report, but did not provide an estimate as to how much of this waste could be recycled in that manner. NRC staff expects that the elemental sulfur and slag would be saleable due to the relative purity of the waste products, as noted above. If on-site disposal of waste is required (potentially due to high carbon content, or market conditions), waste impacts to groundwater and surface water would extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs, though proper management can prevent this pollution. After closure of the waste site and revegetation, the land would be available for other uses

Debris would be generated during construction activities. This would likely be disposed onsite, when possible. Overall, construction phase waste quantities would be small compared to operational wastes, and some of the construction waste could potentially be recycled. As such, construction-stage waste impacts would be SMALL.

For the preceding reasons, the appropriate characterization of impacts from waste generated by an IGCC plant located at the VEGP site would be SMALL. Siting the facility at a site other than VEGP would not alter waste generation, although other sites might have more constraints on disposal locations. Overall impacts of managing wastes generated by a coal IGCC facility are expected to be SMALL whether it is constructed and operated at the VEGP site or an alternate site.

- Human Health

Coal IGCC power generation introduces worker risks from coal mining, from coal transportation, and from disposal of slag as well as transportation of reusable byproducts. In addition there are public risks from inhalation of stack emissions. Emission impacts can be widespread and health risks difficult to quantify. In the GEIS, the NRC staff stated that there would be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but it did not identify the significance of these impacts (NRC 1996).

Regulatory agencies, including EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants, though these emissions are likely to be smaller from IGCC plants than from conventional coal-fired plants. In the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by operation of a coal based IGCC would be characterized as SMALL.

- Socioeconomics

The construction time-frame for an IGCC plant of a size necessary to replace VEGP is unknown as a plant of this size (2,301 MW[e] net) has yet to be constructed. Construction of a smaller IGCC coal based alternative has been estimated to require approximately 4 years (DOE/EIA 2007c); thus, for the present analysis it is assumed that construction would cover a 5-6 year interval. The NRC staff assumed that construction would take place while VEGP continues operation and would be completed by the time it permanently ceases operations in 2027 and 2029. The work force would be expected to be approximately as extensive as that required for the pulverized coal alternate, which brings approximately 2,000 construction workers to the site at the peak of construction activity. These workers would be in addition to the 862 full time employees already stationed at VEGP. During construction, the surrounding communities would experience an increased demand for rental housing and public services, though this demand would be moderated by the proximity of the site to the Augusta-Aiken metropolitan area where a considerable pool of workers is likely to be found. After construction, there would be some impact as construction jobs are lost though these jobs would be absorbed, in the normal course of events, by other economic activity in the region.

If a coal based IGCC plant were constructed at the VEGP site and the nuclear facility shut down, there could be a loss of permanent high-paying jobs. However, job losses at the nuclear facility could be off-set by employment at the IGCC complex. While an estimate of the staff needs for a large IGCC complex is not readily available at this time, it is likely to be considerably greater than that for a pulverized coal facility given the relative complexity of the IGCC facility, with its various syngas processing and waste scrubbing modules in addition to an electric generation block and waste recycling systems. Thus, it is reasonable to conclude that employment could range somewhere between the estimate for pulverized coal burning (400 employees) and the current staff at VEGP (862 employees).

Construction and operation of a coal based IGCC plant at the VEGP site would provide a new tax base that could offset the loss of taxes paid to Burke County when VEGP is shut down. Construction and operation of a coal based IGCC complex at the VEGP site is expected to have SMALL to MODERATE socioeconomic impacts when consideration is given to both construction and operations employment and impacts on the local tax base.

The magnitude of socioeconomic impacts would vary at an alternate site depending on location. During peak construction, there could be up to 2,000 workers at the site, and surrounding communities would experience increased demands on rental housing and public services that could result in SMALL to MODERATE impacts. Upon completion of the new coal-fired power plant, host communities would be affected by the loss of construction jobs but would be offset by approximately 400 new long-term operations jobs at the new plant. Overall, operational impacts could range from SMALL to LARGE. Socioeconomic impacts would be greater (up to LARGE) if the new coal-fired power plant were constructed at a rural location rather than if it were constructed in a more developed urban site.

There would also be a noticeable impact on Burke County due to the loss of jobs and tax revenues should VEGP cease operations and no replacement power plant was built at the VEGP site. Since Burke County currently relies on VEGP for approximately 75 percent of its tax revenue, the loss of that revenue could represent a MODERATE to LARGE socioeconomic impact if the coal-fired power plant were to be constructed at an alternate site.

- Socioeconomics (Transportation)

During the 5 to 6- year construction period of the IGCC complex, as many as 2,000 construction workers would be commuting to the site together with employees of the operating nuclear complex. The addition of construction workers would increase traffic loads on existing highways, particularly on local roadways in and around the plant. These transportation impacts would be SMALL to MODERATE. Transportation-related impacts associated with commuting construction workers at an alternate site are site dependent, but could be SMALL to LARGE.

Transportation impacts of IGCC facility commuting power plant operations personnel are expected to be SMALL. The maximum IGCC operating staff is expected to be no larger than that of the current nuclear complex (862 employees). Transportation impacts at an alternate site of commuting power plant operations personnel would be site dependent but in all likelihood would also be SMALL.

NRC staff estimates that approximately 14 round-trips of unit trains (100 car consists) would be required to deliver coal to the site each week. Additional train or truck movements would occur as a result of hauling slag and sulfur to off site regional markets. The rail line leading to the VEGP site crosses a number of local roadways at-grade and, therefore, extensive delays could be experienced by waiting for unit trains to clear grade crossings. Consequently, rail transportation impacts of coal delivery to the VEGP site are expected to be MODERATE. At an alternate site, coal would also likely be delivered by rail and transportation impacts could range from SMALL to LARGE depending on site location and other characteristics.

- Aesthetics

If an IGCC complex were developed at the VEGP site, the stacks of its gas-fired generators would rise as much as 200 feet above local elevation. Given the tree cover, and the somewhat undulating terrain in the area, the stacks are not likely to be visible offsite. The exhaust stacks would be similar in height to those of a natural gas-fired combined cycle plant, and shorter than those of a pulverized coal unit (400 to 600 ft). Furthermore, given the presence of cooling towers and associated vapor plumes at the site, as well as other structures associated with nuclear operations, the addition of several 200 foot stacks would not drastically increase visual impacts. The facility would also be visible at night because of the need for outside safety lighting; lighting impacts at night could be mitigated by reducing light intensity and installing shields where needed. The NRC staff considers the visual impacts of operating an IGCC complex at the VEGP site to be SMALL.

Coal based IGCC generation would introduce mechanical sources of noise at the site. Given the low population in the vicinity significant impacts to sensitive off-site receptors are not expected. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal delivery, use of outside loudspeakers, and the commuting of plant employees. The incremental noise impacts of an IGCC complex compared to existing VEGP operations would be considered SMALL.

Noise impacts associated with rail delivery of coal to a plant at the VEGP site would be most significant for residents living in the vicinity of the rail route. Passing trains raises noise levels along the rail corridor intermittently. As such impacts to residents along the rail corridor could range from SMALL to MODERATE.

At an alternate site, there would be aesthetic impacts from erecting new buildings, exhaust stacks, cooling towers and, as well, the vapor plumes associated with cooling towers. There would be a significant aesthetic impact associated with construction of a new transmission line to connect plant output to the regional electric grid. Noise and light from the plant may be detectable offsite, depending on site characteristics. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other industrial facilities. Noise impacts from a rail spur, if one is required, would be similar to the impacts at the VEGP site. Overall the aesthetic impacts associated with locating at an alternate site could range from SMALL to LARGE, depending on site characteristics. Some of these issues would be rectified if the IGCC coal plant were sited at a previously developed site where impacts would be expected to be in the range of SMALL to MODERATE.

- Historic and Archaeological Resources

At the VEGP site, a cultural resource inventory would be needed for any onsite property that has not been previously surveyed. Other adjacent properties , if any, that are acquired to support the IGCC complex would also need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at an alternate, undeveloped site, studies would be needed to identify, evaluate, and develop mitigation measures for the potential impacts of new plant construction on cultural resources. The studies would be needed for all areas of potential disturbance at the proposed site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs).

Historic and archaeological resource impacts can generally be effectively managed and as such impacts would be considered SMALL for the existing and SMALL to MODERATE at alternate sites. For a previously developed alternate site, impacts on cultural resources would be SMALL. Previous development would likely either have removed or surveyed items of archaeological interest.

- Environmental Justice

No environmental impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if the IGCC facility were built at the VEGP site. Some impacts on rental and other temporary housing availability and lease prices during construction might occur, and this could disproportionately affect the minority and low-income populations.

Impacts on minority and low-income populations due to the shutdown of VEGP would depend on the number of jobs and the amount of tax revenue lost by Burke County and the communities surrounding the power plant. Closure of VEGP would eliminate jobs and reduce tax revenue in the region that were directly and indirectly attributed to plant operations. However, given the economic growth of Columbia County and the Augusta area, it is likely that these losses could be replaced by the development of new businesses and new sources of tax revenue in the region. Since SNC's tax payments represent a large percentage of Burke County's total annual property tax revenue, it is likely that social services in Burke County would be seriously affected. Therefore, minority and low-income populations in Burke County could experience disproportionately high and adverse socioeconomic impacts from the shutdown of VEGP.

The shutdown of VEGP would reduce operational impacts on the environment. Therefore, minority and low-income populations in the vicinity of VEGP would not likely experience any disproportionately high and adverse environmental impacts from the shutdown of VEGP.

The impact of constructing the IGCC facility at an alternative site would depend on its location in relation to minority and low-income populations. Environmental and economic impacts could range from SMALL to LARGE. Impacts could be larger at previously undeveloped sites, depending on its proximity to minority and low-income populations.

8.2.3 Natural Gas-Fired Combined-Cycle Generation

In this section, NRC staff examines the environmental impacts of the natural gas-fired alternative at both the VEGP site and at an alternate site. The NRC staff assumed that a natural gas-fired plant would use a closed-cycle cooling system. At the VEGP site, the NRC staff assumed that the new plant would make use of the existing cooling system, including cooling tower, intake, and outlet.

Additionally, NRC staff assumed that a replacement natural gas-fired plant would use combined-cycle technology. Compared to simple-cycle combustion turbines, combined cycle plants are significantly more efficient, and thus provide electricity at lower levelized costs. Typically, these plants support intermediate loads but they are capable of supporting a baseload duty cycle and thus provide an alternative to renewing the VEGP operating license. In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery steam generator, which then powers a steam turbine electrical generator.

If a new natural gas-fired plant were built at the VEGP site, approximately 20 miles of new 16-inch gas pipeline would be necessary to connect the new facility to existing gas transmission lines north of the site (SNC 2007b). The NRC staff estimates that running the new gas line would entail disturbance along an approximately 25-foot wide corridor, for 20 miles, resulting in temporary impacts to approximately 60 aces of land. Much of the gas line route would likely be alongside shoulders of existing roadways thus reducing the significance of routing the new line.

For its natural gas-fired alternative the staff evaluates impacts of four combined cycle gas-fired units each with a gross electrical rating of 602.5 MW(e); it is assumed that these units have the same heat rate as used by SNC in their Environmental Report (5,940 Btu/kWh). NRC staff discusses the overall impacts of the natural gas-fired generating system in the following sections and summarizes them in Table 8-4. The extent of impacts at an alternate site would depend on the location of the site selected.

- Land Use

  Existing facilities and infrastructure would be used to the extent practicable, if a gas-fired complex were to be developed at the VEGP site. Specifically, the NRC staff assumed that this alternate would use the existing cooling tower system, switchyard, offices, and transmission line ROWs. Much of the land that would be developed has been previously disturbed. NRC staff, in the GEIS, asserted that a 1,000 MWe gas-fired plant would require 110 acres. As such, a plant of the size proposed to replace VEGP's capacity would require approximately 250 acres. SNC estimated in their Environmental Report that 160 acres would be needed to accommodate a gas-fired complex at VEGP; since substantial infrastructure is already available to support a gas-fired complex, for purposes of the analysis herein the NRC adopts the SNC estimate of needed land area.

  For construction at an alternate site, the NRC staff assumed that 250 acres would be needed for the plant and associated infrastructure. In addition, considerable land area could be disturbed as a result of the need to install gas service to the generating station and the need to clear land for new transmission lines. NRC staff expects that this area would be reduced if a gas-fired alternate were constructed on a previously-developed industrial site since it would be expected that such sites would be near utility transmission systems.

  Regardless of where a gas-fired alternative is built, additional land would be required for natural gas wells and collection stations. According to the GEIS, a 1,000 MW(e) gas-fired plant requires approximately 3,600 acres (1,500 ha) for wells, collection stations, and pipelines (NRC 1996). Much of the land area necessary for the gas-fired alternative would be in existing gas-extraction areas. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for VEGP. In the GEIS (NRC 1996), the NRC staff estimated that approximately 1,000 acres would be affected for mining the uranium and processing it during the operating life of a 1,000 MW(e) nuclear power plant. Overall, land-use impacts could be SMALL to MODERATE for the alternative at the VEGP site. Impacts would generally be similar at an undeveloped site, as the primary driver for these impacts would be the amount of land necessary for natural gas infrastructure. At an alternate site, additional pipelines or transmission lines may also be necessary. As such, impacts could be SMALL to LARGE.

Table 8-5. Summary of Environmental Impacts of Natural Gas-Fired Generation at VEGP and an Alternate Site Using Closed-Cycle Cooling

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	Approximately 160 acres for power block and support facilities. Some existing infrastructure would be used to support gas-fired operations. Additional impact potentially affecting from tens to hundreds of acres for construction of gas pipeline.	SMALL to LARGE	Approximately 250 acres for power block, offices, roads, and parking areas. Power line and gas pipeline impacts may vary widely, from tens of acres to thousands of acres. Previously developed sites would experience lower impacts than undeveloped sites.
Ecology	SMALL	As the alternative would largely use undeveloped areas at VEGP, terrestrial impacts would be minimal. Land disturbance for a new gas pipeline would depend on its route though use of roadway corridors will minimize impacts. Aquatic ecology benefits from the gas-fired alternative, as the combined-cycle plant requires significantly less makeup water and discharges less blowdown than VEGP.	SMALL to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes. At an undisturbed location there could be habitat loss and fragmentation; reduced productivity and biological diversity. These issues would be less significant at a previously developed site.
Water Use and Quality—Surface Water	SMALL	Due to higher thermal efficiency, less cooling tower makeup water needed than for VEGP and also reduced blowdown flows to river.	SMALL to MODERATE	Impact depends on volume of water withdrawn and discharged, as well as characteristics of the surface water body.
Water Use and Quality—Groundwater	SMALL	Somewhat lower groundwater usage for plant services than VEGP.	SMALL to MODERATE	Impact depends on volume of water withdrawn and characteristics of local aquifers.

Table 8-5. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Air Quality	SMALL to MODERATE	Emissions: • Sulfur oxides (175 tons/yr) • Nitrogen oxides (561 tons/yr) • Carbon monoxide (116 tons/yr) • Filterable particulates (98 tons/yr) • Small amounts of hazardous air pollutants	SMALL to MODERATE	Same emissions as at VEGP site.
Waste	SMALL	Solid waste primarily due to emission controls and plant operations.	SMALL	Same waste produced as at the VEGP site.
Human Health	SMALL	Impacts are uncertain, but considered SMALL as the plant would comply with health-informed standards in the Clean Air Act and other relevant emissions regulations.	SMALL	Similar impacts to those at the VEGP site.
Socioeconomics	SMALL to MODERATE	During construction, impacts in surrounding communities would be SMALL to MODERATE, depending on site. Up to 1100 additional workers during the peak of construction period. Impacts could occur as a result of the decrease in on-site operations employment from 862 to 300. Tax base would be preserved. Impacts during operation would be SMALL.	SMALL to LARGE	During construction, impacts in surrounding communities would be SMALL to MODERATE, depending on site. Up to 1100 additional workers during the peak of construction period. Burke County would lose jobs and portion of tax base.

Table 8-5. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts would occur primarily during the peak of construction activity.	SMALL to MODERATE	Expected to be similar to those at VEGP.
Aesthetics	SMALL	Aesthetic impact would be minor given the large plant structures already in-place at VEGP.	SMALL to MODERATE	Greatest impacts from clearing for new transmission line. Overall impact would be SMALL for previously developed sites and SMALL to MODERATE for undeveloped sites.
Historic and Archeological Resources	SMALL	Any potential impacts could be effectively managed given the plant and pipeline's small footprint.	SMALL to MODERATE	Development of a new site and clearing for pipeline and transmission line could disturb these resources.
Environmental Justice	SMALL	Environmental impacts on minority and low-income populations would be similar to those experienced by the general population in the region. Loss of jobs at VEGP may disproportionately affect minority and low-income populations in Burke County.	SMALL to LARGE	Impacts would vary depending on population distribution and location of the site. The loss of jobs at VEGP and tax revenue could disproportionately affect minority and low-income populations in Burke County.

- Ecology

At the VEGP site there could be terrestrial ecological impacts associated with siting a gas-fired facility, though these impacts are likely to be SMALL since much of the new plant would be situated in disturbed areas and impacts to wetland and other useful on-site habitats could be avoided. There would also be some ecological impacts associated with bringing a new underground gas pipeline to the VEGP site, though the scale of this impact is dependent on how much of the pipeline route can follow already disturbed roadway corridors.

Given the relatively high efficiency of a combined cycle facility in relationship to a comparable capacity nuclear plant, the combined cycle's requirements for cooling water would be noticeably reduced from that of VEGP and the resultant impacts to aquatic resources would also be reduced. In addition, cooling tower discharges to the Savannah River would diminish more or less in line with the reduction in make-up flows. Thus, aquatic ecological impacts of the combine cycle alternative would be less than those of the existing VEGP complex and are characterized as SMALL.

Ecological impacts at an alternate site would depend on the nature of the land converted to plant uses and the distances over which new transmission facilities (gas and electric) would need to be run. Ecological impacts to the plant site and to transmission rights-of-way would include wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. At an alternate site, the cooling tower makeup water and discharges would have aquatic resource impacts that depend on the quality of the surface water body from which withdrawals occur. Overall, ecological impacts of developing a combined cycle facility at an alternative site would be considered SMALL if the site were at an already disturbed industrial location and range to LARGE for alternate sites with relatively undisturbed habitat conditions.

- Water Use and Quality

Surface Water. Combined-cycle gas-fired plants are highly efficient and require less cooling water than other technologies such as nuclear and pulverized coal plants. Plant discharges would consist mostly of cooling tower blowdown, with the discharge having a slightly higher temperature and increased concentration of dissolved solids relative to the receiving water body. All discharges from a new plant would be regulated through a National Pollutant Discharge Elimination System (NPDES) permit which would be issued by GDNR. Finally, some erosion and sedimentation would probably occur during construction (NRC 1996), though the GEIS indicates this would be SMALL. Overall, the impacts to water use and quality at the VEGP site from a gas-fired alternative would be considered SMALL, and would be less than the proposed action.

A natural gas-fired plant at an alternate site is assumed to use closed-cycle cooling. The NRC staff assumed that surface water would be used for cooling makeup water and blowdown discharge. The impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharges to any surface body of water would be regulated by GDNR. The impacts would be SMALL to MODERATE depending on receiving water characteristics.

Groundwater. VEGP currently uses about 1.05 mgd of groundwater and it is likely that a gas-fired combined cycle alternative would also use groundwater for various in-plant auxiliary services. Since the impacts of current groundwater usage practices by VEGP are considered SMALL, the impacts of a combined cycle alternate are also estimated to be SMALL. Groundwater usage impacts at an alternate site may vary depending on the nature of aquifers at the alternate location. Given that it is unlikely that a plant at an alternate site would use groundwater for cooling purposes, impacts at an alternate site could range from SMALL to MODERATE.

- Air Quality

Burke County, and the entire Augusta-Aiken Air Quality Control Region within which the county is situated, meets the National Ambient Air Quality Standards established by EPA under the CAA (42 USC 7401). A new gas-fired generating plant developed at the VEGP site would need to comply with the new source performance standards set forth in 40 CFR 60 Subpart D(a) and GG. The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)). A gas-fired power plant constructed elsewhere in Georgia would need to comply with applicable provisions of the CAA, as well, based on the attainment status of the selected alternate site.

Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. EPA issued a new regional haze rule in 1999 (64 FR 35714; EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)).

If a natural gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. Georgia has three designated Class I wilderness areas and South Carolina has one. These areas are listed in Table 8.3. A gas-fired alternate located at the VEGP site would not likely impact visibility at any Class I area since the nearest such area, as can be noted from Table 8.3, is approximately 119 miles from VEGP. For an alternate site, consideration may have to be given to installation of addition air emission control systems if that site were in proximity to any one of the Class I areas. In addition to regulating under the regional haze rule, USEPA also regulates visibility, in general, pursuant to rules at 40 CFR 51, Subpart P.

The State of Georgia regulates air emissions from power plants pursuant to terms of the Georgia Air Quality Act (Part I of Chapter 9 of Title 12 of the Official Code of Georgia Annotated [O.C.G.A. Section 12-9-1, et seq.]). Regulations issued by GDNR (Chapter 391-

3-1) adopt the EPA's CAA rules, with modifications, to limit power plant emissions of SO_x, NO_x, particulate matter, and hazardous air pollutants, among other matters. Depending where a new gas-fired facility is located within the State that facility will need to comply with the applicable Federal and State air regulations

NRC staff projects the following emissions for a gas-fired alternative based on EPA emissions factors (EPA 2000a):

- Sulfur oxides – 175 tons/yr
- Nitrogen oxides – 561 tons/yr
- Carbon monoxide – 116 tons/yr
- Filterable particulates – 98 tons/yr

The total amount of nitrogen oxides which can be emitted by Georgia in the 2008 ozone season (May 1–September 30) is set out at 40 CFR 51.121(e). For Georgia the amount is 150,000 MT (165,306 tons). A new gas-fired power plant would need to buy credits if it was likely to cause the State to exceed these limits.

A natural gas-fired plant would also have unregulated carbon dioxide emissions and, in case of the alternate to VEGP, would emit approximately 5.6 million tons of CO_2 per year. In December 2000, EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). Natural gas-fired power plants were found by EPA to emit arsenic, formaldehyde, and nickel (EPA 2000b). Unlike coal and oil-fired plants, EPA did not determine that emissions of hazardous air pollutants from natural gas-fired power plants should be regulated under Section 112 of the CAA.

Construction activities would also result in some air effects, including those from temporary fugitive dust, though construction crews would employ dust-control practices to limit this impact. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process, though these emissions are likely to be intermittent in nature and will occur over a limited period of time. As such, construction stage impacts would be SMALL.

The overall air-quality impacts of a new natural gas-fired combined cycle plant sited at VEGP or at an alternate site would be SMALL to MODERATE.

- Waste

Burning natural gas results in minor quantities of waste compared to other alternates, though a plant using selective catalytic reduction (SCR) to control NO_x will generate spent SCR catalyst from NO_x emissions control and small amounts of solid-waste products (i.e., ash). In the GEIS, the NRC staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Constructing a gas-fired alternative would generate small amounts of waste, though many construction wastes can be recycled and some debris would be land filled onsite.

Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at VEGP or at an alternate site.

- Human Health

In Table 8-2 of the GEIS, the NRC staff identifies cancer and emphysema as potential health risks from gas-fired plant operations (NRC 1996). The risks may be attributable to No_X emissions that contribute to ozone formation, which in turn can contribute to health impacts. No_X emissions from any gas-fired plant would be regulated as mentioned in the Air Quality section. Overall, the impacts on human health of a natural gas-fired alternate sited at VEGP or at an alternate site would be considered SMALL.

- Socioeconomics

Construction of a natural gas-fired plant would take approximately 4 years (DOE/EIA 2007c). Peak employment would be approximately 1,100 workers (NRC 1996). NRC staff assumed that construction would take place while VEGP continues operation and would be completed by the time it permanently ceases operations. During construction, the communities surrounding the site would experience an increased demand for rental housing and public services that would have SMALL to MODERATE impacts. These impacts would be somewhat reduced if construction workers were to commute to the site from other parts of the region including the Augusta-Aiken metropolitan area.

During operation of the gas-fired complex about 300 full time employees would work at the site, a considerable reduction from the 862 permanent employees currently staffing the VEGP facility. In addition, the current nuclear plant accounts for approximately 75 percent of the property taxes collected by Burke County. Any reduction in taxes paid to the County could impact local services. Given the reduced number of operations workers required for a gas-fired plant, the socioeconomic impacts of this alternate would be SMALL.

Should the new gas-fired plant be built at an alternate site, the loss of taxes and employment in Burke County would have a LARGE impact. At the alternate site, socioeconomic impacts would range from SMALL to MODERATE, depending on site specific conditions.

- Socioeconomics (Transportation)

  Transportation impacts associated with construction of a gas-fired complex at either the VEGP site or an alternate site would range from SMALL to MODERATE due to the daily arrival of up to 1100 construction workers and associated construction equipment. Once operations of the complex begin, transportation system impacts would be SMALL.

- Aesthetics

  At the VEGP site, the turbine buildings (100 ft tall) and four exhaust stacks (approximately 200 ft tall) would not be from offsite due to trees and the undulating terrain. The existing cooling towers are a dominant feature of the VEGP site and would be retained for gas-fired operations. Noise and light from the plant may be detectable offsite, but would be screened by the site's trees. The visual impact, from a new gas-fired plant on the current VEGP site, would be SMALL.

  At an alternate site, new buildings, cooling towers, cooling tower plumes, and electric transmission lines could be visible offsite. Visual impacts from new transmission lines would depend on land uses along the transmission corridor. Aesthetic impacts would be mitigated if the plant were located in an industrial area where land uses are compatible with electric generation activities. Overall, the aesthetic impacts associated with an alternate site could range from SMALL to MODERATE.

- Historic and Archaeological Resources

  At VEGP, a cultural resource inventory would be needed for any onsite property that has not been previously surveyed and would be disturbed by the proposed development. Construction of a gas line to the VEGP site could disturb undeveloped areas along its route and these areas would also need to be surveyed for the presence of archeological resources. Impacts to cultural resources would be SMALL. Most impacts could be mitigated under an approved resource management plan.

  Before construction at an alternate site, studies would be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, or other ROWs). Building on a previously developed site would minimize the likelihood of affecting historical or archaeological resources. At an alternate the impact would be SMALL to MODERATE.

- Environmental Justice

  No environmental impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if the gas-fired plant were built at the VEGP site. Some impacts on rental and other temporary housing availability and lease prices during construction might occur, and this could disproportionately affect the minority and low-income populations.

  Impacts on minority and low-income populations due to the shutdown of VEGP would depend on the number of jobs and the amount of tax revenue lost to Burke County and the communities surrounding the power plant. Closure of VEGP would eliminate jobs and reduce tax revenue in the region that were directly and indirectly attributed to plant operations. However, given the economic growth of Columbia County and the Augusta area, it is likely that these losses could be replaced by the development of new businesses and new sources of tax revenue in the region. Since SNC's tax payments represent a large percentage of Burke County's total annual property tax revenue, it is likely that social services in Burke County would be seriously affected. Therefore, minority and low-income populations in Burke County could experience disproportionately high and adverse socioeconomic impacts from the shutdown of VEGP.

  The shutdown of VEGP would reduce operational impacts on the environment. Therefore, minority and low-income populations in the vicinity of VEGP would not likely experience any disproportionately high and adverse environmental impacts from the shutdown of VEGP.

  The impact of constructing a gas-fired plant at an alternative site would depend on its location in relation to minority and low-income populations. Environmental and economic impacts could range from SMALL to LARGE. Impacts could be larger at previously undeveloped sites, depending on its proximity to minority and low-income populations.

8.2.4 New Nuclear Generation

Since 1997 the NRC has certified four new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the 1,300 MW(e) U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the 1,300 MW(e) System 80+ Design (10 CFR 52, Appendix B), the 600 MW(e) AP600 Design (10 CFR 52, Appendix C), and the 1,100 MW(e) AP1000 Design (10 CFR 52, Appendix C). One additional design is awaiting certification, and five others are undergoing pre-application reviews. All of the designs currently certified or awaiting certification are light-water reactors. Several designs in pre-application review are not light water reactors; these include the helium-cooled Pebble Bed Modular Reactor and the heavy water moderated and cooled Advanced Candu Reactor, ACR-700.

NRC has received several early site permit (ESP) applications, and has approved the first ESPs at the Clinton site near Clinton, Illinois (ESP issued on March 15, 2007), and the Grand Gulf site, in Claiborne County, Mississippi (ESP issued on March 27, 2007). In addition, NRC has received an application for a construction operating license from Dominion Power for a third nuclear unit at the North Anna Generating Station.

In August 2006, SNC submitted an ESP requesting approval of the VEGP site for construction of two Westinghouse Electric AP1000 nuclear units. Applications for construction and operation of the two units may be expected to follow should the site be approved. These applications by SNC and other potential nuclear facility operators indicate continuing interest in the possibility of licensing new nuclear power plants.

Given the growing concern over fossil fuel related green house gas emissions and the expressed industry interest in new nuclear construction, NRC staff will evaluate new nuclear generation as an alternate to renewal of the VEGP operating license. The evaluation will consider locating the new nuclear facility at either the VEGP site (and terminating operations of the two operating units) or at an alternate site. Impacts of continued nuclear plant operations on the VEGP site, beyond the term of the current licenses, are fully evaluated in this draft SEIS (see Chapter 4) and the impact levels presented herein are applicable to a new nuclear plant as well. However, construction impacts associated with developing a new nuclear facility at the VEGP site have not been addressed in Chapter 4 and will be considered here.

NRC staff notes that this analysis addresses the potential impacts of a reactor constructed at the current VEGP site for the purposes of replacing the existing VEGP units. This analysis is not meant to be indicative of the impacts one would expect from the two units SNC has indicated they may possibly construct at the VEGP site, should they complete the combined construction and license (COL) application process and receive approval from the NRC. During that process NRC staff would initiate a separate, detailed environmental impact statement to address the design-specific and site-specific impacts from those units.

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement 1000 MW(e) nuclear power plant built to one of the certified designs. As such, the impacts outlined in this table need to be adjusted to reflect impacts of two AP1000 units (total output of 2,200 MW(e) for the VEGP new nuclear reactor alternative.[f] The environmental impacts associated with transporting fuel and waste to and from a light-water

(f) NRC staff notes that while Table S-3 does not estimate impacts from unregulated CO_2 emissions during the nuclear fuel cycle, Table S-3 does indicate that energy consumed during the cycle is roughly equal to that generated by a 45 conventional coal-fired plant, and thus provides a means of approximating unregulated CO_2 emissions.

cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. NRC staff summarize findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR 51 Subpart A, Appendix B.

NRC staff discusses the overall impacts of constructing and operating a new, two-unit, nuclear complex at the VEGP site and at an alternate site in the following paragraphs. Table 8-6 then compares the impacts associated with developing the two-unit complex at the two sites. Operating phase impacts associated with two new units at the VEGP site are based on the analysis presented in Chapter 4 which evaluates impacts of license renewal for the reactors currently operating at VEGP. However, the NRC staff assumed that the new nuclear plant would have a 40-year lifetime to allow for comparisons between a new nuclear plant and other alternatives. This assumed period also coincides with the initial licensing period for a new nuclear plant.

As indicated in the following paragraphs, the extent of impacts at an alternate site would heavily depend on the location and characteristics of the particular site:

- Land Use

  The existing facilities and infrastructure at the VEGP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the NRC staff assumed that a replacement nuclear power plant would use the existing cooling tower system, switchyard, offices, and transmission line rights-of-way. Much of the land that would be used has been previously disturbed. SNC estimates that approximately 400 aces of the VEGP site would be disturbed if two new nuclear plants were constructed to replace the currently operating complex (SNC 2007a). While some of the area that would be needed for the new facility would already be highly disturbed, it is likely that considerable area currently used for tree farming or that otherwise has habitat value (including wetlands, streams and open water) would be developed. Thus, the land use impacts associated with constructing the new nuclear facility would be MODERATE while operation of the new plant would have SMALL land use impacts.

  Land-use impacts at an alternate site would be similar to siting at VEGP except for the land needed for transmission lines necessary to connect to the grid, and a rail spur to allow delivery of major components and fuel. Depending on the site, anywhere from tens to thousands of acres may be necessary. The need to construct transmission and rail capacity would likely be reduced at a previously developed industrial site, though it would likely result in MODERATE to LARGE land-use impacts.

- Ecology

Due to the 400 acres of land disturbance associated with construction of a new nuclear facility at the VEGP site the terrestrial ecological impacts are considered to be SMALL. Terrestrial and aquatic ecological impacts related to plant operations would be SMALL as presented in Chapter 4 of this DSEIS.

For an alternate site, there would be both on-site and off-site ecological impacts during construction and operation of the new nuclear facility. Even assuming siting at a previously disturbed location, the impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity, depending on the degree to which the site was previously disturbed and how much remediation has taken place. A new nuclear plant at an alternate site would likely employ cooling towers and would potentially incur aquatic impacts comparable to those of the existing VEGP units. At an alternate site ecological impacts would likely be MODERATE to LARGE, due primarily to impacts to terrestrial ecology. However, actual impact levels would depend on characteristics of the alternate site.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the VEGP site and at an Alternate Site Using Closed-Cycle Cooling

Impact Category	VEGP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Land Use	MODERATE	Impacts occur as a result of disturbing up to 400 acres of existing VEGP site during construction.	MODERATE to LARGE	On-site requirements in the range of 500 to 1500 acres. Off-site transmission lines and railway potentially impact hundreds of acres.
Ecology	SMALL	Impacts are to terrestrial ecosystem as a result of land disturbance during construction.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.

Table 8-6. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Water Use and Quality—Surface water	SMALL	Impacts are expected to be comparable to existing plant.	SMALL to MODERATE	Impact would depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality—Groundwater	SMALL	The current plant uses groundwater for several services and impacts are SMALL. New plant would have comparable impacts.	SMALL to MODERATE	Impact would depend on the volume of water withdrawn, as well as characteristics of the aquifer. Groundwater would not be used for cooling system makeup water.
Air Quality	SMALL	Impacts are expected to be SMALL because construction emissions are short term and operational emissions are minor.	SMALL	Same impacts as at VEGP site.
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same as at VEGP
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1.	SMALL	Same as at VEGP site.

Table 8-6. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE, with up to 4,400 workers during the peak of the 6-year construction period. The operating work force assumed to be similar to VEGP; tax base preserved in Burke County, but may change in surrounding counties if workers don't transfer from one plant to another. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts depend on location. Impacts at a rural location would be LARGE. Burke County would experience a loss of tax revenue while surrounding counties would lose employment, though growth in the region could offset these impacts.
Socioeconomics (Transportation)	SMALL to MODERATE	Transportation impacts from construction activities would be MODERATE. Transportation impacts of commuting plant personnel would be SMALL even if their commuting patterns differ from current plant employees.	SMALL to LARGE	Transportation impacts would be MODERATE to LARGE, primarily with construction activities. Transportation impacts of commuting plant personnel would be SMALL to MODERATE.
Aesthetics	SMALL	No new exhaust stacks or cooling towers would be needed. New containment and turbine buildings would be visible in the immediate vicinity of the plant. Visual impact at night would be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and would be mitigated.	MODERATE to LARGE	Greatest impact is likely from new cooling towers. Also, transmission lines would have noticeable impacts. Containment and other building would also be noticeable

Table 8-6. (cont'd)

Impact Category	VEGP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Historic and Archeological Resources	SMALL	Any potential impacts could be effectively managed. Any offsite land acquired would need to be surveyed.	SMALL to MODERATE	Any undeveloped land would need to be surveyed prior to development. Impact likely smaller at previously developed site and could be effectively managed.
Environmental Justice	SMALL	Impacts on minority and low-income communities would be similar to those experienced by the general population. Some impacts on rental housing may occur during construction, though most personnel are expected to travel from nearby urban areas.	SMALL to LARGE	Impacts would vary depending on population distribution and location of the site. The loss of jobs at VEGP and tax revenue could disproportionately affect minority and low-income populations in Burke County. However, impacts to minority and low-income populations from the closure of VEGP would likely to be offset by economic growth in the region.

- Water Use and Quality

Surface Water. Should a new two-unit nuclear facility be constructed and operated at the VEGP site to replace the currently operating units, the impacts to surface waters would be expected to be SMALL. At an alternate site, plant cooling would be provided by means of a closed cycle system. The impact on nearby surface waters would depend on the volume of water needed for makeup, the discharge flow rates, and characteristics of the receiving water body. Intake from and discharge to any surface water would be regulated by the GDNR. The impacts would be SMALL to MODERATE.

Groundwater. Impacts to groundwater are expected to be SMALL if a new nuclear facility is constructed at the VEGP site and the existing facility licenses are not renewed. Groundwater use would be an option for a nuclear plant at an alternate site. However, it is unlikely that a new nuclear facility would use groundwater for cooling purposes which is the major water demand generated by large steam-electric stations. Groundwater withdrawals at an alternate site would require permits from the State permitting authority (GDNR in the case of a plant in Georgia). Overall, groundwater impacts at an alternate site would be SMALL to MODERATE.

- Air Quality

Construction of a new nuclear plant at either the VEGP site or an alternate site would result in fugitive dust emissions during the construction process. These impacts would be intermittent and short-lived. To minimize dust generation, construction crews would use applicable dust-control measures. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process, but these would also be of limited duration. An operating nuclear plant would have minor air emissions associated with diesel generators and other small-scale intermittent sources. Overall, air emissions and associated impacts would be SMALL.

- Waste

The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR 51, Subpart A, Appendix B. Construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts would be SMALL for either the VEGP site or an alternate site.

- Human Health

Human health impacts for an operating nuclear power plant are set out in 10 CFR 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts would be SMALL.

- Socioeconomics

Representative construction period and the peak work force associated with construction of a new nuclear power plant at VEGP are presented in the *Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site (NUREG-1872)* (NRC 2007). NRC staff assumed a construction period of 6 years and a peak work force of 4,400. The NRC staff assumed that construction would take place while the existing nuclear unit continues operation and would be completed by the time VEGP permanently ceases operations. During construction, the communities surrounding the VEGP site would experience an increase demand for rental housing and public services that would have SMALL to MODERATE impacts. These impacts could be reduced by construction workers commuting to the site from other parts of the Augusta area or from other counties. After construction, the communities would be impacted by the loss of the construction jobs. An alternative site would experience SMALL to LARGE impacts, depending on characteristics of the surrounding community and local economy. The new nuclear units are assumed to have an operating work force of up to 660 workers. The replacement nuclear alternative would provide new and/or additional tax revenue to offset the loss of revenue associated with the decommissioning of VEGP. New employment at an alternative site, as well as the region's economic growth, would also likely offset any loss of VEGP jobs. *Socioeconomic impacts for a replacement nuclear alternative* constructed at VEGP would be SMALL; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area. In comparison, socioeconomic impacts for a replacement nuclear alternative at a rural site could be LARGE.

- Socioeconomic (Transportation)

During the 6-year construction period, up to 4,400 construction workers would commute to the VEGP site in addition to the 890 workers at VEGP. The addition of the construction workers, equipment, and material would increase traffic loads on existing roads around the plant. Such impacts would be MODERATE. Transportation impacts related to commuting of plant operating personnel would be similar to current impacts associated with operation of VEGP and would be SMALL.

Construction of a replacement nuclear power plant at an alternate site would relocate some socioeconomic impacts, but would not eliminate them. The communities around the VEGP site would still experience the impact of operational job loss, though this could be offset by economic growth in the region. The communities around the new site would have to absorb the impacts of a large, temporary work force (up to 4,400 workers at the peak of construction) and a permanent work force of approximately 660 workers. In the GEIS (NRC 1996), the NRC staff indicated that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction work force would need to move to the area to work. The VEGP site is within commuting distance of the Augusta urban area. Transportation-related impacts associated with commuting construction workers at an alternate site are site dependent, but would be MODERATE to LARGE. These may be mitigated somewhat if the new nuclear power plant would be built on a previously developed site nearer to large population centers. Transportation impacts related to commuting of plant operating personnel at an alternate site would also be site dependent, but would be characterized as SMALL to MODERATE.

- Aesthetics

The containment building for a replacement nuclear power plant sited at VEGP, existing cooling tower, and as other associated buildings would be visible in daylight hours over many miles, though extensive forestation on site may help screen these structures. The replacement nuclear unit may be visible at night because of outside lighting. Visual impacts could be mitigated by landscaping and selecting a color for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding. No exhaust stacks would be needed. Visual impacts would likely be SMALL.

Noise impacts from a new nuclear plant would be similar to those from the existing VEGP units. Given the land area available around the plant, and potential noise mitigation measures, such as reduced use of outside loudspeakers, the impact of noise would be SMALL.

At an alternate site, there would be an aesthetic impact from the buildings, cooling towers, and the plume associated with the cooling tower. There would also be a significant aesthetic impact associated with construction of a new transmission line to connect to other lines to enable delivery of electricity. Noise and light from the plant would be detectable offsite. The impact of noise and light would be mitigated if the plant is located in an industrial area adjacent to other power plants or industrial land uses. Overall the aesthetic impacts associated with locating at an alternative site would be categorized as MODERATE to LARGE, depending on site characteristics. The greatest contributor to this categorization would be the aesthetic impact of the cooling towers and transmission lines.

- Historic and Archaeological Resources

At the VEGP site, a cultural resource inventory would likely be needed for any onsite and offsite property that has not been previously surveyed. Any land acquired to support the new plant would also need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site. Impacts are expected to be SMALL.

Before beginning construction at an alternate site, studies would be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed. Effects at an undeveloped site would be SMALL to MODERATE.

- Environmental Justice

No environmental impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at the VEGP site. Some impacts on housing availability and lease prices during construction might occur, and this could disproportionately affect the minority and low-income populations.

Impacts on minority and low-income populations due to the shutdown of VEGP would depend on the number of jobs and the amount of tax revenue lost to the communities surrounding the power plant. Closure of VEGP would reduce the overall number of jobs and tax revenue generated in the region that were directly and indirectly attributed to plant operations. However, given the economic growth of Columbia County and the Augusta area, it is likely that these losses would be replaced by the development of new businesses and new sources of tax revenue in the region. Since SNC's tax payments represent a large percentage of Burke County's total annual property tax revenue, it is likely that social services in the county would be seriously affected by the shutdown of VEGP. Therefore, the loss of jobs and tax revenue from the shutdown of VEGP could disproportionately affect minority and low-income populations in Burke County.

The environmental effect of plant shutdown would also reduce the amount of operational impacts on the environment. Therefore, minority and low-income populations in the vicinity of VEGP would not likely experience any disproportionately high and adverse environmental impacts from the shutdown of VEGP.

Impacts at an alternate site would depend upon the site chosen and population distribution, and would likely be SMALL to LARGE.

8.2.5 Conservation

In this section, NRC staff evaluates conservation[(g)] as an alternative to license renewal. According to the American Council for an Energy-Efficient Economy (ACEEE) State Energy Efficiency Scorecard for 2006, Georgia ranks 38th in the country in terms of implementation of energy efficiency programs (Eldridge et al. 2006) suggesting there is considerable opportunity for enhancing the State's conservation efforts.

The Georgia Public Service Commission (GPSC) is currently taking a number of steps to balance the State's energy markets through new energy efficiency practices. One such step is requiring that State-regulated utilities, such as the Georgia Power Company (GPC), submit an Integrated Resource Plan (IRP) for its approval every three years. The IRP demonstrates the economic, environmental, and other benefits of the utility's plans to, among other things,

(g) NRC staff notes that conservation typically refers to all programs that reduce energy consumption, while energy efficiency refers to programs that reduce consumption without reducing services. For this section, NRC staff will use the terms interchangeably.

improve energy efficiency, operate alternative sources of energy, and expand Demand Side Management (DSM). GPC submitted its latest IRP on January 31, 2007 and the GPSC approved it by Order dated July 12, 2007 (GPSC 2007). Beyond approving the IRP, the Order requires that GPC expand its DSM programs (including conservation programs) beyond those proposed in the IRP to "capture more of the economic and achievable potential to improve end-use energy efficiency."

The GPC IRP proposed five new DSM pilot programs: the Power Credit Multifamily Program, the Programmable Thermostat with Home Performance with ENERGY STAR Program, the Compact Fluorescent Light Bulb Program, the Electric Water Heater Insulation Program, and the Commercial Tax Incentive Program. The GPSC found that each of the five pilot programs proposed by the GPC should be approved on a pilot basis and that the GPC shall begin implementation of each of these five programs no later than January 1, 2008 (GPSC 2007). In addition to the five pilot programs, the GPSC is also requiring that the GPC expand several other DSM programs including a weatherization assistance funding program, programs that encourage the use of energy efficient appliances, commercial lighting tax incentives programs, and commercial and residential building tax incentive programs.

In a report prepared for the Georgia Environmental Facilities Authority, ICF Consulting (ICF 2005a) discusses the potential to cost effectively increase energy efficiency in the State if the appropriate programs and policies were to be implemented. The intent of the report is to identify latent energy efficiency potential that can be readily captured through policy interventions over a five to ten year period.

In their report, ICF uses a series of mathematical models to estimate the energy savings that that could realistically be attained by efficiency-related policy and program interventions. The firm modeled three intervention scenarios identified as Minimally Aggressive, Moderately Aggressive, and Very Aggressive. For each scenario an estimate was generated of the reduction in peak demand and electric sales that could be achieved by sector (residential, commercial, and industrial). In terms of peak energy demand, ICF concluded that the two primary contributors were air conditioning and lighting which accounted for 65 percent of the peak.

ICF estimates of potential reductions in peak demand in the fifth year following implementation of the policy and program interventions for the three scenarios are 447 MW(e), 1,149 MW(e), and 1,608 MW(e). ICP proposes options for reaching these targets in a companion report that describes investment programs and policies that would be needed to support a state-wide conservation program (ICF 2005b).

ICF recommends a portfolio of targeted investment programs that could be implemented to capture at least a substantial portion of the potential reduction in peak demand (ICP 2005b). Target areas of the portfolio include:

- Residential lighting and appliances
- Small commercial and industrial (hard-to-reach) users
- New commercial and industrial construction
- Custom incentives for commercial and industrial users
- Prescriptive rebates for commercial and industrial users

The ICF report also recommends State-sponsored direct intervention policies which produce significant energy savings by eliminating the least efficient technologies and practices from the market. Direct intervention policies target building codes, appliance/equipment efficiency standards, and tax credits to set an efficiency floor. The ICF report also recommends the use of State-sponsored enabling policies to stimulate consumer investment in energy saving measures.

While it is not clear as to the extent to which GPSC, in their order to GPC mandating expansion of the utility's demand side management programs, has embraced the analysis and results of the ICF study, the principal requirements imposed on GPC by the GPSC Order directly address the principal contributors to peak demand established by ICF: lighting and air conditioning. Therefore, it appears reasonable to assume that the policies supported by GPSC in their Order will, as they are implemented, capture to some extent the energy efficiency benefits estimated by ICF.

In the absence of quantifiable peak demand reductions that will result from the GPSC Order, the lack of documented commitment to the ICF report recommendations, and the absence of quantifiable program achievements to date, NRC staff will not evaluate conservation or efficiency programs as replacement for the full output of the VEPG. NRC staff will, however, consider conservation as part of a combined alternative.

For the purpose of the analysis presented in Section 8.2.8 (Combination of Alternative), it is assumed that Georgia meets the Moderately Aggressive conservation goal of 1,149 MW(e) before the VEPG operating licenses expire. However, GPC anticipates taking approximately 600 MW(e) base load off line with the retirement of the McDonough Units 1 and 2 coal-fired plants resulting in a net conservation of about 550 MW(e) (GPSC 2007). It is further assumed that conservation efforts during the license renewal period can result in an additional 450 MW(e) demand reduction (the approximate difference in the Moderately Aggressive and Very Aggressive savings estimates). Therefore the combined alternative will include 1,000 MW(e) from conservation.

8.2.6 Purchased Electrical Power

Georgia imported approximately 57.9 gigawatt-hours of electricity in 2004 (EIA 2007c) and essentially none of this power, as would be expected, came from international sources.

According to SNC (Vogtle Environmental Report, 2007) some of the imported power may be the result of existing purchase contracts which would prevent it from being used to replace VEGP.

Additionally, SNC has entered into long term purchase contracts with several entities to provide firm capacity and energy. SNC views these contracts as part of their current and future capacity and does not consider those purchases to be applicable to replacement of VEGP (Vogtle Environmental Report, 2007). In their July 12, 2007 Order, the GPSC mandates that GPC issue a request for proposal for base load resources that have been identified in the utility's Integrated Resource Plan, as being needed to meet future demand. Thus, based on the language of the Order, resources that would be so purchased would not be intended to replace the output of VEGP.

While it is expected that GPC could purchase additional capacity and energy beyond that already being planned, the NRC staff also considers it likely that the technologies that would be used to generate the purchased power would be one of those that have already been evaluated in this report. These include pulverized coal, gas-fired combined cycle systems, and IGCC facilities, among others. Impacts of those technologies have been shown to exceed the impacts of license renewal. Thus, the NRC staff does not view purchasing power to be an environmentally preferable alternative.

8.2.7 Other Alternatives

Other generation technologies NRC staff considered but determined to be individually inadequate to serve as alternatives to VEGP are discussed in the following paragraphs.

8.2.7.1 Oil-Fired Generation

EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States during the 2007 to 2030 time period, and overall oil consumption for electricity generation will decrease because of higher fuel costs and lower efficiencies (DOE/EIA 2007a). Oil-fired generation is more expensive to operate than nuclear or coal-fired plants, though it is less expensive than either to construct. Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline for use in electricity generation. For these reasons, oil-fired generation will not be evaluated as an alternative to VEGP license renewal.

8.2.7.2 Wind Power

Power generation from wind on an industrial scale is a relatively recent development. The first "modern" commercial wind farm was constructed in California in 1981 of individual units capable of producing 50 kilowatts (kW). As of 2007, land-based wind turbines with generating capacities up to 2.5 MW, and marine-based (offshore) wind turbines up to 5.0 MW, were commercially available (Georgia Institute of Technology, Southern Company 2007). The largest single coastal wind-farm installation is the Arklow wind farm under construction off Ireland's eastern coast; it will have 200 wind turbines with a total nominal capacity of 520 MWe. In the US, the Cape Wind Energy Project, planned for coastal Massachusetts, will, if constructed, have a maximum electrical output of 468 MWe and an average output of 182 MWe (Cape Wind Energy Project, DEIS, DOI/MMS, January 2008).

Wind resources in Georgia are generally concentrated off the state's Atlantic coast. The vast majority of the state is a class one (poor) wind power region, with limited areas of class two and three (marginal and fair) wind power regions found in the state's northern areas and near the Atlantic coast. Off the Atlantic coast, however, large swaths of class 4 and 5 (good to excellent) wind power regions are available. A smaller area of wind power region class 6 (outstanding) is also available, but at great distance (more than 45 miles) from the coastline (Georgia Wind Working Group 2007).

Wind power, by itself, has not historically been considered suitable for large base-load capacity, due to the high degree of variability associated with wind availability at any given installation. Annual capacity factors of individual wind plants are relatively low (on the order of 30 to 40 percent), compared to other generation technologies, and the potential for no generation capacity whatsoever at any given time is incompatible with base-load requirements. However, as the installed base of wind power facilities increases, the question of base-load capacity from wind is being reevaluated in terms of the probability of minimum continuous generating capacity available from networks of multiple wind farms located in different wind regimes (Auswind 2007).

The ratio of base-load capacity to total generating capacity from sufficiently dispersed wind farms has been described as being in the range of one-third to one-fifth (Diesendorf 2007), with the precise ratio dependent upon the aggregate wind characteristics of the entire wind farm network. This range is theoretical, however; many utilities assign no base-load capacity to wind power, and utilities that do accept wind as base-load capacity typically do so at even lower ratios (on the order of one-seventh) than the literature suggests may be possible.

Assuming that a one-third ratio of total capacity to base-load capacity ultimately proves feasible, then replacing VEGP's safe summertime output of 2,301 MW with widely dispersed wind farm installations would require a total capacity in the range of 6,900 MW. If achieved entirely with 5 MWe, offshore units, 1,380 wind turbines would be required to replace VEGP's capacity. Such an installation would be on the order of seven times the size of any existing installation, and is significantly beyond the scale of wind farm installations attempted to date. As such, it is not considered feasible at this time.

Given limitations on potential wind power sites, as well as relatively low capacity factors, NRC staff does not consider wind power to be a suitable stand-alone alternative to VEGP license renewal. NRC staff does, however, does recognize that Georgia likely has utility-scale wind resources available, and that supplementing wind power installations with more conventional and readily dispatchable power sources (such as gas-fired turbines) alters the estimation of what might be considered as base-load capacity from the combined system. Because short- to medium-term wind forecasting can be conducted with a high degree of confidence, it is possible to predict in advance when shortfalls of base-load capacity solely from wind may occur, and to arrange for replacement capacity from more traditional peak-load technologies. As such, NRC will include wind power (primarily situated along Georgia's coast line) in a combination alternative addressed in Section 8.2.8.

8.2.7.3 Solar Power

Solar technologies, both thermal and photovoltaic, use the sun's energy to produce electricity without producing fuel wastes, air pollution, or greenhouse gases.

In thermal solar power plants sunlight is first concentrated using mirrors. The concentrated light is directed at a heat collector that contains a heat transfer fluid that powers an engine or steam turbine. Because thermal solar power plants can use only the direct component of the sunlight they appear to be unsuitable in areas with high humidity and frequent cloud cover, both of which result in scattering. Moreover, an annual average solar radiation, at ground level, of 6.0 or more kilowatt-hours per square meter per day is required for viable solar power generation (Leitner 2002). Most of the state of Georgia, including the VEGP site, receives an average of 4 to 4.5 kWh of direct solar radiation per square meter per day (DOE 2007). As a result of the inadequate levels of incident radiation and Georgia weather conditions, the NRC staff will not evaluate thermal solar power as an alternative to license renewal of VEGP.

Photovoltaic systems convert sunlight directly into electricity. Photovoltaic collectors, which are simply flat panels that can be mounted on a roof or on the ground, are typically fixed in a tilted position correlated to the latitude of the location. This allows the collector to best capture the sun. These collectors can use both the direct solar rays and reflected light that comes through a cloud or off the ground. Because they use all available sunlight, flat-plate collectors are the best choice for many northern states with relatively low levels of solar radiation or for southeastern states with high humidity and frequent cloud cover. Currently, the VEGP site receives an average of 5 to 5.5 kWh of solar radiation (direct and diffusive) per square meter per day, as does much of Georgia (DOE 2007). While weather conditions in Georgia suggest that photovoltaic cells would be the more likely solar alternate to replace VEGP, land required for such systems are about four acres per MW. Assuming that photovoltaic panels can cover 50 percent of the land area on which they are deployed, a 2,301 MW(e) photovoltaic power plant would encompass an area of about 18,400 acres. Even assuming a percentage of panels could be mounted on existing structures (rooftops, etc.), the impact of developing such an extensive site would be significant in terms of ecological and aesthetic considerations.

In the GEIS, the NRC staff also noted that solar power is intermittent; therefore, additional collectors would be necessary to account for shading. In addition, a solar powered alternative would require energy storage or a backup power supply to provide electric power at night. Solar power is currently significantly more costly than most other alternatives for a given amount of capacity, and as adding energy storage technologies only increases the cost of solar power, NRC staff will not evaluate solar power further as an alternative to license renewal of VEGP.

8.2.7.4 Hydropower

The Idaho National Laboratory (INL) estimates that Georgia has 275.3 MW of technically available, undeveloped hydroelectric resources (INL 1998). This amount occurs entirely in installations of 100 MW or less. This potential is 88 percent less than VEGP's capacity, and thus is insufficient to serve as an alternative to license renewal. As such, hydropower would not be considered as a feasible alternative to VEGP license renewal at this time.

However, as part of the DOE Hydropower Program, DOE (in conjunction with several federal, private, and public entities) is currently conducting further research and development to improve the overall benefits of hydropower and to provide cost-competitive technologies that enable the development of new hydropower capacity. This includes new resource assessments of the undeveloped conventional hydropower potential in each state (DOE 2007).

8.2.7.5 Geothermal

Geothermal resources include a wide variety of heat sources from the earth. This resource includes both hydrothermal energy sources and the earth's deeper, stored thermal energy (MIT, 2006). Unfortunately, conventional hydrothermal fluid resources are limited in terms of their location, in that the most intense and, therefore, the most valuable of these resources are located in the western continental United States, Alaska, and Hawaii (DOE EERE, 2006).

In an effort to evaluate the future of geothermal energy, an MIT-led 18-member interdisciplinary panel was assembled in September 2005 (MIT, 2006). The panel evaluated the impact of Enhanced Geothermal Systems (EGS)- engineered reservoirs created to extract economical amounts of heat from low permeability geothermal resources-and provided expertise on resource characterization and assessment, drilling, reservoir stimulation, and economic analyses. The panel found that there is great potential for energy recovery using technologies for sustainable heat-mining from large volumes of accessible hot rock, available anywhere in the United States. The installed capacity of EGS could reach 100,000 MWe within 50 years (MIT, 2006), however, at the present time these enhanced systems require further funding, research and development.

8.2.7.6 Wood Waste and Other Biomass Derived Fuels

DOE notes that Georgia has excellent biomass resource potential (DOE 2007). In particular, Georgia has the largest area of commercially-forested land in the United States at 24.2 million acres, and already has significant infrastructure for timber harvesting in place (GDED 2007).

An analysis conducted by the Center for Agribusiness and Economic Development at the University of Georgia found that there are approximately 18.3 million tons of biomass fuels available in Georgia on an annual basis, and that these fuels, if fully converted to electricity using the applicable best available technologies (without consideration of cost), could supply as much as 11.8 percent of Georgia's 2006 electric demand (Shumaker, George A., Audrey Luke-Morgan, Tommie Shepherd and John C. McKissick. 2007. "The Economic Feasibility of Using Georgia Biomass for Electrical Energy Production." University of Georgia Center for Agribusiness and Economic Development: Athens, Georgia (Shumaker 2007). While the study did not present conversion efficiencies for each of the 14 different types of biomass fuels analyzed, the average conversion efficiency for all 18.3 million tons of potentially available biomass fuel was approximately 885 kWH/ton. At that conversion efficiency, it is likely that only a limited quantity of electricity could be generated on an annual basis at a cost competitive with coal-fired generation (Shumaker 2007). However, if consideration is given to fuels with generating costs up to 25% higher than a coal-fired alternative (but still less than that of natural gas- or petroleum-fired alternatives), it is estimated that considerable biomass derived energy could be generated cost effectively.

However, such estimates of biomass capacity contain substantial uncertainty. Production of biomass-source electricity is still a nascent industry, and is not believed to be feasible on an industrial scale at this time (Shumaker 2007). Also, potential availability does not mean these resources would actually be available at the prices indicated or that resources would be free of contamination. Some of these waste streams already have reuse value, and their acquisition on a scale necessary to compensate for significant portions of the VEGP output is likely to significantly alter their market value (Walsh et al. 1999). The consequence would be higher prices for electric generation feedstock as well as a need to identify replacements for waste streams diverted to electric generation that are currently used for other purposes. Additionally, some feedstock may prove unsustainable to harvest on a regular basis.

While the GEIS notes that wood-waste plants are able to operate in a base load duty cycle, the larger wood-waste power plants have capacities in the range of 50 MW(e). Thus, 46 wood waste plants may be necessary to replace the capacity of VEGP, given the current state of the technology. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve use of similar combustion equipment.

It is the NRC Staff's view that Georgia has utility-scale wood waste resources, but given uncertainties in supply estimates, as well as the relatively large number of small units necessary to replace VEGP, the NRC staff does not believe wood waste is a viable energy alternative to renewal of the VEGP operating license. However, NRC staff will include wood waste facilities in a combination alternative addressed in Section 8.2.8.

8.2.7.7 Municipal Solid Waste

In the United States, in 2006, 251.3 million tons of Municipal Solid Waste (MSW) was generated of which 32.5 percent was recycled, 55 percent was discarded to landfills or handled by other disposal methods and only 12.5 percent was combusted with energy recovery (EPA OSWER 2007).

The practice of incinerating municipal refuse and, in the process, extracting useable energy, has increased over the last 50 years (essentially no such facilities existed in the US in 1960). This has occurred for two principal reasons: incineration reduces the volume of material that needs to land filled and the electricity that can be generated in the process avoids the cost of increasingly expensive fossil fuels. Currently there are approximately 89 waste-to-energy plants operating in the United States. These plants generate approximately 2,500 MW(e), or about 0.3 percent of total national power generation (EPA OSWER 2003).

Estimates in the GEIS suggest that the overall level of construction impact from a MSW combustion facility would be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have operational impacts on the aquatic environment, air, and waste disposal. MSW power plants require a similar amount of water per unit of electricity generated and combustion of MSW generates atmospheric emissions of NO_2, SO_2, particulates, and trace amounts of toxic pollutants.

The principal by-product of MSW combustion is ash, which can contain toxic contaminants that were present in the initial waste. Under current regulations, MSW ash must be sampled and analyzed regularly to determine whether it is hazardous or not, and if hazardous must be properly managed. Non-hazardous ash can be recycled for use in projects such as road constriction or disposed in a landfill.

Although combustion of MSW has many of the same environmental impacts as combustion of fossil fuels, MSW is recognized as a renewable energy source since the material would otherwise be sent to landfills. However, economic factors, regulatory issues, and increasing community opposition to MSW combustion at the local level, have limited construction of new facilities. There is some possibility that with increasing energy prices municipal waste combustion may once again become attractive.

Given the relatively small scale of MSW plants from an electric output perspective, and the complex regulatory environment that would be faced by any proposal to site such facilities, the NRC staff does not consider MSW combustion to be a feasible alternative to VEGP license renewal and will not consider it further in this draft SEIS.

8.2.7.8 Fuel Cells

Fuel cells work without combustion and therefore do not present the environmental side effects of combustion processes. In a fuel cell, power is produced electrochemically by passing hydrogen over an anode and air (or oxygen) over a cathode and separating the two by an electrolyte. Hydrogen can be extracted from fuels that contain hydrocarbons such as natural gas, methane, coal-based gas, methanol, ethanol, gasoline, biomass and landfill gas. It can also be produced from water using renewable solar, wind, hydro or geothermal energy. If pure hydrogen is used no discernible pollutants are produced. The principal by-products would be water and heat. If hydrocarbon fuels are used, carbon dioxide is also a by-product. However, because, in a fuel cell, fuel is converted directly into electricity without going through an intermediate combustion step the emission of carbon dioxide is much less than that from conventional fossil fueled plants. Direct conversion to electricity also results in fuel cells having high efficiencies. According to the DOE, the electrical efficiency of fuel cells is up to 60 percent and higher when by-product heat is utilized. This is approximately double the efficiency of traditional combustion technologies that have efficiencies of 33 to 35 percent (DOE 2006).

Land requirements for fuel cells are relatively small in comparison to those of renewable technologies. For example the dimensions of the DFC 3000 fuel cell manufactured by Fuel Cell Energy with an output of 2,400 kW are 60 x 105 feet. Therefore, a 2,301 MW(e) fuel cell plant requires about 139 acres of land area for installation of a fuel cell system. Even assuming 50 percent additional land for transmission systems, parking, administration, etc., the required area is 278 acres or less than half that for a comparable nuclear alternate.

Fuel cell technology has many advantages. It produces pollution free energy. The fuel cells are quiet, reliable, safe and easy to maintain. However, the materials and manufacturing costs associated with catalysts, bipolar plates, membranes, and gas diffusion layers are extremely expensive. Installed capital cost, in 2010, is predicted to be in the range of 5,466 dollars per KW (DOE/EIA 2007a). This is too high to compete with conventional power plants. For the stationary fuel cells systems, a price point of 400 to 750 dollars per KW is considered necessary for widespread commercialization. Also, to be considered a viable technology for stationary power plants the durability of fuel cell systems would have to be increased to the 40,000 hour range.

Even though portable and stationary fuel cells are being used for backup power, at the present time, fuel cells are not economically or technologically competitive with other alternatives for base load generation. While it may be possible to use a distributed array of fuel cells to provide an alternate to VEGP, it would be prohibitive to do so at current costs.

8.2.7.9 Delayed Retirement

Retirement plans are addressed in the GPC IRP and are reviewed by the GPSC in their Order dated July 12, 2007. In their IRP, the utility designated two units for retirement, Units 1 and 2 at Plant McDonough. A decision approving retirement of these two units has been postponed by the Commission to a future proceeding. The two units are coal fired, have been operating since 1963 and 1964, and each have generator nameplate ratings of 299 MW(e). Apparently, it is GPC's plan to replace these units with a lager natural gas-fired facility at the same site. Given that no other retirement options are considered by the GPSC, the NRC staff concludes that delay of planned retirements would not be a viable alternate to renewal of the VEGP license.

8.2.8 Combination of Alternatives

Even though individual alternatives to license renewal might not be sufficient on their own to replace the 2,464 MW(e) total capacity of the two VEGP units due to the lack of cost-effectiveness or availability, it is conceivable that a combination of alternatives might be sufficient.

There are many possible combinations of alternatives that could be considered to replace the VEGP. One possible combination of alternatives examined in this section consists of a 800 MW(e) of combined-cycle natural gas-fired plant, 500 MW(e) of purchased power, a net 1,000 MW(e) from current and future conservation programs, and about 200 MW(e) from a combination of wood-fired plants and wind resources. These resources would provide an alternative that roughly approximates the amount of power produced by VEGP Units 1 and 2.

Siting an 800 MW(e) gas-fired unit with closed-cycle cooling at the VEGP site would likely have SMALL ecological impacts and socioeconomic impacts The potential environmental impacts of the construction and operation of the gas-fired plant are provided in Table 8-5.

Participating in 1,600 MW(e) of energy conservation programs (1,000 MW[e] net), as described in Section 8.2.5, would have overall SMALL impacts. Purchasing 500 MW(e) from other sources would also have a SMALL overall impact. As such, these two components of the combined alternative are not included in the summary of environmental impacts in Table 8-7.

The GEIS indicates that wood-fired plants would serve base load capacity, but that they tend to operate at low efficiencies and are economic only when feedstocks are very inexpensive. In addition, the GEIS notes that gathering fuel for wood-fired plants can have significant environmental impacts. However, NRC staff believes that the operation of 100 to 200 MW(e) of wood-fired generation would have SMALL impacts especially if the plants were widely distributed and feedstocks were primarily pre-existing waste streams. Construction impacts of the wood-fired plants would be SMALL to MODERATE depending on plant cooling configurations and plant locations. These impacts would be mitigated by locating plants on previously disturbed land near other industrial applications, including paper/pulp mills or other forest-products operations.

NRC staff notes that Georgia's coastal areas provide significant wind resources for the development of substantial wind power generation and that large scale facilities are being planned and constructed at other offshore locations. A 100 to 200 MW(e) peak capacity wind installation using 5 MWe turbines (a capacity that is now becoming available) would entail placing 20 to 40 wind turbines off coastal Georgia. A wind installation capable of delivering 100 to 200 MWe on average would require placing approximately 52 to 104 turbines (MMS 2008). The principal environmental impacts of such an installation would be those to aquatic ecological resources and possibly aesthetic impacts as has been the case at other proposed coastal locations. Ecological impacts would occur during the construction phase and could be managed by choice of construction methods (for example, avoiding particularly sensitive habitats). Aesthetic impacts would occur during operation of the wind installation and would depend on its distance form the shore and on its orientation in regard to shoreline communities. The NRC staff estimates that the construction and operational impacts of the facility could be managed so as to be no greater than MODERATE.

The combined potential environmental impacts of the construction and operation of the wood-fires plants and the off-shore wind farm are summarized in Table 8-7.

Overall, the impacts of this combination of alternatives would be MODERATE as a result of the air emissions associated with the gas-fired portion of the alternative, the loss of permanent jobs and tax revenues in Burke County, and the potential aesthetic impacts of the coastal wind installation.

1 **Table 8-7.** Summary of Environmental Impacts of a Combination of Alternative
2

Impact Category	800MW(e) Gas-fired VEGP Site (Closed-cycle Cooling)		Other Alternatives at Off-site Locations	
	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	Impacts of construction of the natural gas plant on the VEGP site would not result in the significant use of undisturbed areas. Additional impact potentially affecting 60 acres for construction of gas pipeline.	SMALL	Impacts would depend on the site selection for the wood-fired plants.
Ecology	SMALL	See Table 8-5.	SMALL to MODERATE	Impacts would depend on the site selection for the wood-fired plants and the off-shore wind farm construction methods.
Water Use and Quality—Surface water	SMALL	See Table 8-5.	SMALL	Impacts would be minor because of the small total output and possible multiple locations of the wood-fired plants. Off-shore wind farm impacts would also be minor.
Water Use and Quality—Groundwater	SMALL	See Table 8-5.	SMALL	Impacts would be minor because of the small total output and possible multiple locations of the wood-fired plants. An off-shore wind farm would not impact groundwater resources.
Air Quality	MODERATE	Table 8-5 emissions reduced by a factor of 3 based on plant size reduction.	SMALL	Air emissions of the small wood-fired plants would be minor considering their size and possible multiple locations. An off-shore wind farm would not impact on air quality.

Table 8-7. (cont'd)

Impact Category	800MW(e) Gas-fired VEGP Site		Other Alternatives at Off-site Locations	
	Impact	Comments	Impact	Comments
Waste	SMALL	See Table 8-5.	SMALL	The overall power output from the other alternatives would not result in significant waste volumes.
Human Health	SMALL	See Table 8-5.	SMALL	The overall power output from the other alternatives would not result in significant waste volumes.
Socioeconomics	SMALL	Impacts could occur as a result of the decrease in on-site employment from 862 to 300. Tax base would be preserved. Impacts during operation would be SMALL.	SMALL	Small plant sizes, possible multiple locations, and off-shore construction.
Socioeconomics (Transportation)	SMALL to MODERATE	See Table 8-5.	SMALL	Transportation impacts would be SMALL because of small plant sizes, possible multiple locations, and off-shore construction. Minor impacts of commuting plant personnel.
Aesthetics	SMALL	See Table 8-5.	MODERATE	MODERATE visual and noise impacts from new off-shore wind turbines, depending on the location. Limited impact from wood-fired plants.
Historic and Archeological Resources	SMALL	See Table 8-5	SMALL	Small plant sizes, possible multiple locations, and off-shore construction.

Table 8-7. (cont'd)

Impact Category	800MW(e) Gas-fired VEGP Site		Other Alternatives at Off-site Locations	
	Impact	Comments	Impact	Comments
Environmental Justice	SMALL	Impacts on minority and low-income populations would be similar to those experienced by the general population in the region. Loss of jobs at VEGP may disproportionately affect minority and low-income populations in Burke County.	SMALL	Small plant sizes, possible multiple locations, and off-shore construction.

8.3 Summary of Alternatives Considered

In this DSEIS the NRC staff has considered alternative actions to license renewal of the VEGP plants including the no-action alternative (discussed in Section 8.1), new generation or energy conservation alternatives (coal-fired supercritical and IGCC generation, natural gas, nuclear, and conservation alternatives discussed in Sections 8.2.1 through 8.2.5, respectively), purchased electrical power (discussed in Section 8.2.6), alternative technologies (discussed in Section 8.2.7), and a combination of alternatives (discussed in Section 8.2.8).

As established in the GEIS, the need for power from VEGP is assumed by NRC in the license renewal process. Should NRC not renew VEGP's licenses, this amount of generating capacity or load reduction would have to come from an alternative to license renewal.

Furthermore, even if NRC renews the operating license, SNC could elect to meet its capacity and energy needs with an alternative other than continued VEGP operation. Decisions about which alternative to implement, regardless of whether or not NRC renews the VEGP operating license, are left to utility and state-level decision makers (or non-NRC Federal level decision makers where applicable).

The environmental impacts from those alternatives to license renewal that NRC staff considered would be greater than the impacts of continued VEGP operation under a renewed license. License renewal would have all SMALL impacts except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal. While the impacts of conservation measures are also likely to be SMALL, the Staff has determined, based on findings of the GPSC in relationship to the GPC IRP, that conservation cannot reasonably be forecast to replace the output of VEGP. Conservation, together with other technologies, could replace VEGP's capabilities but the impacts of those other technologies (e.g., coal, gas, wind, etc.) are likely to be greater than impacts of renewing the VEGP operating license.

The NRC staff concludes, then, that the environmentally preferred alternative for meeting future electrical needs of the Sate of Georgia is renewal of the VEGP operating license thereby providing decision makers the option of operating VEGP for another 20 years beyond expiration of its operating license.

8.4 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10 *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

40 CFR Part 50. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

Australian Wind Energy Association (Auswind). 2007. "Development of the Non-Fossil Fuel Energy Industry in Australia." Submission to the House of Representatives Standing Committee on Industry and Resources, Inquiry into developing Australia's non-fossil fuel energy industry, Case study into selected renewable energy sources. Melbourne, Australia. June.

Clean Air Act of 1970, as amended (CAA). 42 USC 7401, *et seq.*

Department of Energy (DOE). 1999. "Market-Based Advanced Coal Power Systems Final Report." DOE/FE-0400. May. Accessed at: http://www.netl.doe.gov/technologies/coalpower/refshelf/marketbased_systems_report.pdf on December 2, 2007.

Department of Energy (DOE). 2000. "The Wabash River Coal Gasification Repowering Project: Final Technical Report." Accessed at: http://www.osti.gov/bridge/purl.cover.jsp?purl=/787567-a64JvB/native/ on December 2, 2007.

Department of Energy (DOE). 2004. "Tampa Electric Integrated Gasification Combined Cycle Project: Project Performance Summary." Accessed at: http://www.netl.doe.gov/technologies/coalpower/cctc/resources/pdfs/tampa/Tampa_PPS.pdf on December 2, 2007.

Department of Energy (DOE). 2006. Hydrogen Fuel Program. "Hydrogen Fuel Cells" fact sheet. October. Accessed at: http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/doe_h2_fuelcell_factsheet.pdf on December 18, 2007.

Department of Energy (DOE). 2007. "State Energy Alternatives: Alternative Energy Resources in Georgia." Accessed at: http://www.eere.energy.gov/states/alternatives/resources_ga.cfm on December 17, 2007.

Department of Energy, Energy Efficiency and Renewable Energy (DOE/EERE). 2006. "EERE State Partnerships and Activities: State energy alternatives." Accessed at: http://www.eere.energy.gov/states/alternatives/geothermal.cfm?print on January 9, 2008.

Department of Energy, Energy Information Administration (DOE/EIA). 2004. "Energy Consumption by Source and Total Consumption per Capita, Ranked by State, 2004." Accessed at: http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use_per_cap.html on December 5, 2007.

Department of Energy, Energy Information Administration (DOE/EIA). 2005. "Annual Energy Review 2005." Washington, D.C. Accessed at: http://tonto.eia.doe.gov/FTPROOT/multifuel/038405.pdf on December 3, 2007.

Department of Energy, Energy Information Administration (DOE/EIA). 2006. "Annual Energy Review 2006." DOE/EIA-0384 (2006). Washington, D.C. Accessed at: http://www.eia.doe.gov/aer/ on December 3, 2007.

Department of Energy, Energy Information Administration (DOE/EIA). 2007a. "Annual Energy Outlook 2007 With Projections to 2030." DOE/EIA-0383 (2007). Washington, D.C. Accessed at: http://tonto.eia.doe.gov/FTPROOT/forecasting/0383(2007).pdf on December 3, 2007.

Department of Energy, Energy Information Administration (DOE/EIA). 2007b. "Cost and Quality of Fuel for Electric Plants." DOE/EIA-0191 (2007). Washington, D.C. Accessed at: http://www.eia.doe.gov/cneaf/electricity/cq/cq_sum.html on December 3, 2007.

Department of Energy, Energy Information Administration (DOE/EIA). 2007c. "Assumptions to the Annual Energy Outlook 2007 with Projections to 2030." DOE/EIA-0554 (2007). Washington, D.C. Accessed at: http://www.eia.doe.gov/oiaf/aeo/assumption/index.html on December 3, 2007.

Department of Energy, National Renewable Energy Laboratory (DOE/NREL). 2004. "Biomass and Biofuels." Accessed at: http://www.nrel.gov/gis/il_biomass.html on May 23, 2007.

Diesendorf, Mark. 2007. "The Base Load Fallacy." EnergyScience Coalition. March. Accessed at: http://www.cana.net.au/documents/Diesendorf_TheBaseLoadFallacy_FS16.pdf on December 18, 2007.

Ekbom, Tomas. 2007. "Major IGCC Projects World-Wide." Nykomb Synergetics AB, Stockholm, Sweden. February 1. Accessed at: http://www.nykomb.se/index.php?s=Projects on December 12, 2007.

Eldridge, Maggie, Bill Prindle, Dan York, Steve Nadel. 2006. "The State Energy Efficiency Scorecard for 2006." American Council for an Energy-Efficient Economy, Report Number E075. June.

Environmental Protection Agency (EPA). 1998a. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources: AP 42, Fifth Edition. "Section 1.1: Bituminous and Sub-bituminous Coal Combustion: Final Section Supplement E." Accessed at: http://www.epa.gov/ttn/chief/ap42/ch01/index.html on December 3, 2007.

Environmental Protection Agency (EPA). 1998b. "Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units; Revisions to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam Generating Units, Final Rule. 63 FR 49453. Federal Register Volume 63, Number 179, pp. 49442-49455. Washington, D.C.

Environmental Protection Agency (EPA). 1999. "Regional Haze Regulations, Final Rule." 64 FR 35714. Federal Register Volume 64, Number 126, pp. 35714-3577. Washington, D.C.

Environmental Protection Agency (EPA). 2000a. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources: AP 42, Fifth Edition. "Section 3.1: Stationary Gas Turbines: Final Section Supplement F." Accessed at: http://www.epa.gov/ttn/chief/ap42/ch03/index.html on December 3, 2007.

Environmental Protection Agency (EPA). 2000b. "Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units." Federal Register. Volume 65, Number 245, pp. 79825-79831. Washington, D.C.

Environmental Protection Agency (EPA). 2002. Office of Air Quality Planning and Standards. "EPA Air Pollution Control Cost Manual, Sixth Edition." EPA/452/B-02-001.

Environmental Protection Agency (EPA). 2006. "Revision of December 2000 Clean Air Act Section 112(n), Finding Regarding electric Utility Steam Generating Units; and standards of Performance for New and Existing Electric Utility Steam Generating Units." Accessed at: http://www.epa.gov/camr/pdfs/camr_recon_fr_final_053106.pdf on December 5, 2007.

Environmental Protection Agency (EPA). 2007. "Clean Air Mercury Rule." Accessed at: http://www.epa.gov/camr on December 3, 2007.

Environmental Protection Agency (EPA), Solid Waste and Emergency Response (OSWER). 2007. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and figures for 2006." EPA-530-F-07-030. November. Accessed at: http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw06.pdf on December 17, 2007.

Gabbard, Alex. 1993. "Coal Combustion: Nuclear Resource or Danger," *Oak Ridge National Laboratory Review.* Oak Ridge National Laboratory: Oak Ridge, Tennessee. Summer/Fall 1993. Accessed at: http://www.ornl.gov/ORNLReview/rev26-34/text/colmain.html on December 5, 2007.

Georgia Department of Economic Development (GDED). 2007. "Georgia's Biomass Industry – Backgrounder." Accessed at: http://www.georgia.org/NR/rdonlyres/38BCF806-AF1F-419F-A93A-C397EEEB5110/0/GABiomassBackgrounderFINAL.pdf on December 18, 2007.

Georgia Department of Natural Resources, Environmental Protection Division, Air Division Branch. 2007. Amendments to the Rules of the Department of Natural Resources Environmental Protection Division Relating to Air Quality, Chapter 391-3-1. Clean Air Mercury Rule. July. Accessed at: http://www.air.dnr.state.ga.us/airpermit/cair/downloads/20070627SOSPkg%20AirCAMRRules.pdf on December 18, 2007.

Georgia Institute of Technology, Southern Company. 2007. "Southern Winds: Summary Report 2007." Strategic Energy Institute. Accessed at: http://www.energy.gatech.edu/research/Summary-Southern-Winds.pdf on December 18, 2007.

Georgia Public Service Commission (GPSC). 2007. "Order Adopting Stipulation". Docket Number 24505-U: Document Number 104010. Date decided: July 12, 2007. Accessed at: http://www.psc.state.ga.us/facts/documentresults.asp?page=2.

Georgia Wind Working Group. "Wind Resource of Georgia, Mean Annual Wind Speed at 90 Meters." Accessed at: http://www.gawwg.org/windresources/georgiawindresourcemap.html. on November 21, 2007.

Hong, B.D., and E.R. Slatick (Hong and Slatick). 1994. Energy Information Administration, "Quarterly Coal Report," January-April 1994, DOE/EIA-0121. Accessed at: http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html on December 5, 2007.

ICF Consulting. (ICF). 2005a. "Georgia Environmental Facilities Authority Assessment of Energy Efficiency Potential in Georgia Final Report." May 5. Accessed at: http://www.gefa.org/Index.aspx?page=347 on December 5, 2007.

ICF Consulting. (ICF). 2005b. "Georgia Environmental Facilities Authority Strategies for Capturing Georgia's Energy Efficiency Potential." May 5.

Idaho National Laboratory (INL). 1998. "U.S. Hydropower Resource Assessment for Georgia." DOE/ID-10430(GA). Idaho Falls, Idaho. October. Accessed at: http://hydropower.id.doe.gov/resourceassessment/index_states.shtml?id=ga&nam=Georgia on December 17, 2007.

Leitner, A. 2002. "Fuel from the Sky: Solar power's potential for Western energy supply." July. NREL/SR-550-32160. Accessed at: http://www.nrel.gov/docs/fy02osti/32160.pdf on December 12, 2007.

Massachusetts Institute of Technology (MIT). 2006. "The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century." Prepared with Idaho National Laboratory for the U.S. Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Geothermal Technologies.

National Energy Technology Laboratory (NETL). 2007. "Energy Analyses > Technology Analysis, NETL's 2007 Coal Power Plant Database." Accessed at: http://www.netl.doe.gov/energy-analyses/technology.html on December 17, 2007.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, *et seq.*

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437. Volumes 1 and 2, Washington, D.C.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report*, "Section 6.3--Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

Nuclear Regulatory Commission (NRC). 2002. *Final Generic Impact Statement on Decommissioning of Nuclear Facilities*. NUREG-0586, Supplement 1. Washington, D.C.

Progress Energy Carolinas, Inc. (Progress Energy). 2006. Shearon Harris Unit 1, Applicant's Environmental Report, Operating License Renewal Stage. Raleigh, North Carolina. Accessible at http://www.nrc.gov/reading-rm/adams/web-based.html at Accession Number ML063350276.

Ratafia-Brown, Jay A., Lynn M. Manfredo, Jeff W. Hoffman, Massood Ramezan, Gary J. Stiegel. 2002. "An Environmental Assessment of IGCC Power Systems." Presented at the Nineteenth Annual Pittsburgh Coal Conference, September 23-27, 2002, Pittsburgh, PA.

Rosenberg, William G., Dwight C. Alpern, Michael R. Walker. 2004. "Deploying IGCC in this Decade with 3Party Covenant Financing: Volume I." ENRP discussion paper, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, Cambridge, MA. July.

Southern Nuclear Operating Company, Inc. (SNC). 2006. "Vogtle Electric Generating Plant Early Site Permit Application, Part 3 -Environmental Report." Public Disclosure Version. Accessible at http://www.nrc.gov/reading-rm/adams/web-based.html at Accession NumbersML0622962290298-ML062290304.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plan Units 1 and 2*, Docket Numbers 50-424 and 50-425.

Southern Nuclear Operating Company, Inc. (SNC). 2007b. *License Renewal Application, Vogtle Electric Generating Plant,* Docket Numbers 50-424 and 50-425, Facility Operating License Numbers NPF-68 and NPF-81.

U.S. Geological Survey (USGS). 1997. "Radioactive Elements in Coal and Fly Ash: Abundance, Forms, and Environmental Significance; USGS Fact Sheet FS-163-97." Accessed at: http://greenwood.cr.usgs.gov/energy/factshts/163-97/FS-163-97.pdf on December 5, 2007.

Wall Street Journal (WSJ). 2007. "Duke Energy is Cleared to Build New Power Plant." In Brief. 21 November 2007, Technology Section: B5.

Walsh, Marie E., Robert L. Perlack, Anthony Turhollow, Daniel de la Torre Ugarte, Denny A. Becker, Robin L. Graham, Stephen A. Slinsky, and Daryll E. Ray. 1999. "Biomass Feedstock Availability in the United States: 1999 State Level Analysis." Accessed at: http://bioenergy.ornl.gov/resourcedata/index.html on December 3, 2007.

9.0 Summary and Conclusions

By letter dated June 27, 2007, Southern Nuclear Operating Company, Inc. (SNC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Vogtle Electric Generating Plant Units 1 and 2 (VEGP) for an additional 20-year period (SNC 2007a). If the operating licenses are renewed, State and Federal (other than NRC) regulatory agencies and SNC would ultimately decide whether the plant will continue to operate based on factors such as the need for power, power availability from other sources, regulatory mandates, or other matters within the agencies' jurisdictions or the purview of the owners. If the operating licenses are not renewed, then the plant must be shut down at or before the expiration of the current operating licenses, which expires on January 16, 2027 for Unit 1 and February 9, 2029 for Unit 2.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA; 42 USC 4321) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. 10 CFR Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), NRC requires preparation of an EIS or a supplement to an EIS for renewal of a reactor operating licenses; 10 CFR 51.95(c) states that the EIS prepared at the operating licenses renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996 and 1999).[a]

Upon acceptance of the VEGP application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare an EIS and conduct scoping (*Federal Register*, Volume 72, page 43296 [NRC 2007]) on August 3, 2007. The Staff held two public scoping meetings on September 27, 2007 and visited the VEGP site and conducted a site audit in October 2007. The Staff reviewed the VEGP Environmental Report (Environmental Report) (SNC 2007b) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The Staff also considered the public comments received during the scoping process for preparation of this draft Supplemental Environmental Impact Statement (SEIS) for VEGP. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this draft SEIS.

[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

The Staff plans to hold public meetings in Waynesboro, Georgia, in June 2008 to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on this draft SEIS. When the comment period ends, the Staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action (including cumulative impacts), the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse effects. This draft SEIS also includes the Staff's preliminary recommendation regarding the proposed action.

The NRC has adopted the following statement of purpose and need for license renewal from the GEIS:

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers.

The evaluation criterion for the Staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine:

> . . . whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that would contribute to NRC's ultimate determination of whether an existing nuclear power plant continues to operate beyond the period of the current operating licenses.

NRC regulations (10 CFR 51.95(c)(2)) contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition,

the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b).[b]

The GEIS contains the results of a systematic evaluation of the consequences of renewing an operating licenses and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For 69 of the 92 issues considered in the GEIS, the Staff analysis in the GEIS shows the following:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the Staff relied on conclusions as amplified by supporting information in

(b) The title of 10 CFR 51.23 is "Temporary storage of spent fuel after cessation of reactor operations–generic determination of no significant environmental impact."

the GEIS for issues designated Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.
Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must also be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the Staff's consideration of all 92 environmental issues identified in the GEIS. The Staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the operating licenses for VEGP), alternative methods of power generation, and conservation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the VEGP site or some other unspecified location.

9.1 Environmental Impacts of the Proposed Action - License Renewal

SNC and the Staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither SNC nor the Staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process, SNC, nor the Staff has identified any new issue applicable to VEGP that has a significant environmental impact. Therefore, the Staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to VEGP.

SNC's license renewal application presents an analysis of the Category 2 issues that are applicable to VEGP, plus environmental justice and chronic effects from electromagnetic fields. The Staff has reviewed the SNC analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Two Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at VEGP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. SNC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of VEGP for the license renewal period (SNC 2007a). In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2* (NRC 1985).

Twelve Category 2 issues (including eleven Category 2 issues plus the severe accident mitigation alternatives [SAMAs] issue from Chapter 5) related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. For the 12 Category 2 issues and environmental justice, the Staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. Research is continuing in the area of chronic effects on electromagnetic fields, and a scientific consensus has not been reached. Therefore, no further evaluation of this issue is required. For SAMAs, the Staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for VEGP, and the plant improvements already made, the Staff concludes that SNC identified two potentially cost-beneficial SAMAs. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The Staff concludes that cumulative impacts of VEGP license renewal would be SMALL for all potentially affected resources.

Mitigation measures were considered for each Category 2 issue. For all issues, current measures to mitigate the environmental impacts of plant operation were found to be adequate.

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

All unavoidable adverse impacts of continued operation identified are considered to be of SMALL significance. The unavoidable adverse impacts of likely alternatives if VEGP ceases operation at or before the expiration of the current operating licenses will not be smaller than those associated with continued operation of this unit, and they may be greater for some impact categories in some locations.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of VEGP during the current license period was made when the plant was built. The resource commitments to be considered in this draft SEIS are associated with continued operation of the plant for an additional 20 years. These resources include materials and equipment required for plant maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent off-site storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent storage space. VEGP replaces a portion of its fuel assemblies during every refueling outage, which occurs on an 18-month cycle (SNC 2007b).

The likely power generation alternatives if VEGP ceases operation on or before the expiration of the current operating licenses would require a commitment of resources for construction of the replacement facilities as well as for fuel to run the plants.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at VEGP was set when the plant was approved and construction began. That balance is now well established. Renewal of the operating licenses for VEGP and continued operation of the plant would not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the operating licenses would lead to shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the operating licenses for VEGP. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at VEGP. Chapters 4 through 7 discuss environmental issues associated with renewal of the operating licenses. Environmental

issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.
The significance of the environmental impacts from the proposed action (approval of the application for renewal of the operating licenses), the no-action alternative (denial of the application), alternatives involving coal, gas, or nuclear-fired generating capacity at an unspecified greenfield site, gas-fired generation of power at VEGP, and a combination of alternatives are compared in Table 9-1. Continued use of open-cycle cooling is assumed for VEGP. All fossil fueled alternatives presented in Table 9-1 are assumed to use closed-cycle cooling systems.

Substitution of once-through cooling for the recirculating cooling system in the evaluation of the nuclear and gas and coal-fired generation alternatives would result in greater environmental impact to categories related to water use and aquatic ecology. Alternatively, land use and aesthetic impacts are somewhat reduced with open-cycle cooling.

Table 9-1 shows that the significance of the plant specific environmental effects of the proposed action would be SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from high-level radioactive waste spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental impacts in at least some impact categories that reach MODERATE or LARGE significance.

9.3 Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996 and 1999), (2) the Environmental Report submitted by SNC, (3) consultation with Federal, State, and local agencies, (4) the Staff's own independent review, and (5) the Staff's consideration of public comments received, the preliminary recommendation of the Staff is that the Commission determine that the adverse environmental impacts of license renewal for VEGP are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No Action Alternative, and Alternative Methods of Generation Using Once-Through Cooling[a]

	Proposed Action	No Action Alternative	Supercritical Coal-Fired Generation		Coal (IGCC) Generation	
Impact Category	License Renewal	Denial of Renewal	VEGP Site	Alternate Site	VEGP Site	Alternate Site
Land Use	SMALL	SMALL	MODERATE	MODERATE to LARGE	MODERATE	MODERATE to LARGE
Ecology	SMALL	SMALL	MODERATE	MODERATE to LARGE	MODERATE	MODERATE to LARGE
Water Use and Quality – Surface Water	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Use and Quality - Groundwater	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL
Human Health	SMALL[c]	SMALL	SMALL	SMALL	SMALL	SMALL
Socio-economics	SMALL	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Transportation	SMALL	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Aesthetics	SMALL	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Historical and Archeological Resources	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Environmental Justice	SMALL	MODERATE to LARGE	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE

Table 9-1. (cont'd)

	Natural-Gas-Fired Generation [b]		New Nuclear Generation [b]		Combination of Alternatives	
					Gas Fired with Biomass Fired Plant, Wind Park, Purchased Power and Conservation	
Impact Category	VEGP Site	Alternate Site	VEGP Site	Alternate Site[b]	VEGP Site	Alternate Site
Land Use	SMALL to MODERATE	SMALL to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL
Ecology	SMALL	SMALL to LARGE	SMALL	MODERATE to LARGE	SMALL	SMALL to MODERATE
Water Use and Quality – Surface Water	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL
Water Use and Quality - Groundwater	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL
Air Quality	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL	MODERATE	SMALL
Waste	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socio-economics	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL	SMALL
Transportation	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL
Aesthetics	SMALL	SMALL to MODERATE	SMALL	MODERATE to LARGE	SMALL	MODERATE
Historical and Archeological Resources	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL
Environmental Justice	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL	SMALL

(a) The majority of impacts shown are negative; however, several impacts are positive. See Chapters 4 and 8 for details.
(b) Analysis based on use of a closed-cycle cooling system.
(c) Except for the collective offsite radiological impacts from the fuel cycle and from high level waste and spent-fuel disposal, for which a significance level was not assigned. See Chapter 6 for details

9.4 References

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.

Nuclear Regulatory Commission (NRC). 1985. *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2.* NUREG-1087, Washington, DC.

Nuclear Regulatory Commission (NRC). 1996. NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS), Volumes 1 and 2. Washington, DC, May, 1996.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3, Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

Nuclear Regulatory Commission (NRC). 2000. "Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal." NUREG-1555, Supplement 1, Washington, DC.

Nuclear Regulatory Commission (NRC). 2007. "Notice of Receipt and Availability of Application for Renewal of Vogtle Electric Generating Plant, Units 1 and 2 Facility Operating Licenses Nos. NPF-68 andNPF-81, for an Additional Twenty-Year Period." *Federal Register* Volume 72, p. 43296. August 3, 2007.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *License Renewal Application, Vogtle Electric Generating Plant, Docket Numbers 50-424 and 50-425, Facility Operating License Numbers NPF-68 and NPF-81.*

Southern Nuclear Operating Company, Inc. (SNC). 2007b. *Applicant's Environmental Report – Operating License Renewal Stage, Wolf Creek Generating Station. Docket Numbers 50-424 and 50-425.*

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

Part I - Comments Received During Scoping

As outlined by National Environmental Policy Act (NEPA), the U.S. Nuclear Regulatory Commission (NRC) initiated the scoping process with the issuance of the *Federal Register* Notice. On September 14, 2007, the NRC published a Notice of Intent in the *Federal Register* (FR; 72 FR 52586), to notify the public of the Staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 regarding the renewal application for the Vogtle Electric Generating Plant Units 1 and 2 (VEGP) operating license. The plant-specific supplement to the GEIS will be prepared in accordance with NEPA, Council on Environmental Quality (CEQ) guidelines, and 10 CFR Part 51. The NRC invited the applicant, Federal, State, local, and tribal government agencies, local organizations, and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than October 24, 2007. The scoping process included two public scoping meetings, which were held at the Augusta Technical College, Waynesboro/ Burke Campus, 216 Highway 24 South, Waynesboro, Georgia on September 27, 2007. The NRC issued press releases and distributed flyers locally. Approximately 50 people attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process and the NEPA process. Following the NRC's prepared statements, the meetings were open for public comments. Thirteen (13) attendees provided oral comments that were recorded and transcribed by a certified court reporter. The transcripts of the meetings can be found as an attachment to the meeting summary, which was issued on October 12, 2007. The meeting summary is available for public inspection in the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The meeting summary and can be found in ADAMS at Accession No. ML072840963. The transcripts can be found in ADAMS at Accession Nos. ML072840529 and ML072840530, for the afternoon and evening sessions, respectively. The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams/web-based.html. Persons who do not have access to ADAMS, or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's Public Document Room Reference staff by telephone at 1-800-397-4209, or 301-415-4737.

The scoping process provides an opportunity for public participation to identify issues to be addressed in the plant-specific supplement to the GEIS and highlight public concerns and issues. The Notice of Intent identified the following objectives of the scoping process:

- Define the proposed action,

- Determine the scope of the supplement to the GEIS and identify significant issues to be analyzed in depth,

- Identify and eliminate peripheral issues,

- Identify any environmental assessments and other environmental impact statements being prepared that are related to the supplement to the GEIS,

- Identify other environmental review and consultation requirements,

- Indicate the schedule for preparation of the supplement to the GEIS,

- Identify any cooperating agencies, and

- Describe how the supplement to the GEIS will be prepared

At the conclusion of the scoping period, the NRC staff and its contractor reviewed the transcripts and all written material received, and identified individual comments. All comments and suggestions received orally during the scoping meetings or in writing were considered. Each set of comments from a given commenter was given a unique alpha identifier (Commenter ID letter), allowing each set of comments from a commenter to be traced back to the transcript, letter, or email in which the comments were submitted. Several individuals submitted comments through multiple sources (e.g., letter and afternoon or evening scoping meetings).

Comments were consolidated and categorized according to the topic within the proposed supplement to the GEIS or according to the general topic if outside the scope of the GEIS. Comments with similar specific objectives were combined to capture the common essential issues that had been raised in the source comments. Once comments were grouped according to subject area, the Staff and contractor determined the appropriate action for each comment.

Table 1 identifies the individuals providing comments and the Commenter ID letter associated with each person's set(s) of comments. The Commenter ID letter is preceded by VEGP (short for Vogtle Electric Generating Plant). For oral comments, the individuals are listed in the order in which they spoke at the public meeting.

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID	Commenter	Affiliation (If Stated)	Comment Source
VEGP-A	Sara Barczak	Safe Energy Director, Southern Alliance for Clean Energy	Afternoon Scoping Meeting
VEGP-B	Walter Dukes	VP, Georgia Power Company	Afternoon Scoping Meeting
VEGP-C	James Hendrix	Director, SRS Community Reuse Organization	Afternoon Scoping Meeting
VEGP-D	Billy Hopper	Former City and County Administrator	Afternoon Scoping Meeting
VEGP-E	Dick Byne	Waynesboro City Council	Afternoon Scoping Meeting
VEGP-F	Ellis Godbee	Former County Commissioner	Afternoon Scoping Meeting
VEGP-G	Bobbie Paul	Director, Women's Action for New Direction	Afternoon Scoping Meeting
VEGP-H	Teresa Carter	American Cancer Society	Afternoon Scoping Meeting
VEGP-I	Reverend Charles Utley	Resident	Afternoon Scoping Meeting
VEGP-J	A.K. Hasan	CSRA Citizens for Nuclear Energy	Afternoon Scoping Meeting
VEGP-K	Walter Dukes	VP, Georgia Power Company	Evening Scoping Meeting
VEGP-L	J.B. Powell	State Senator	Evening Scoping Meeting
VEGP-M	Gloria Frazier	State Representative	Evening Scoping Meeting
VEGP-N	Jesse Stone	Mayor, Waynesboro, Georgia	Evening Scoping Meeting
VEGP-O	Sara Barczak	Safe Energy Director, Southern Alliance for Clean Energy	Written Comments

The comments and suggestions received as part of the scoping process are documented in this section, and the disposition of each comment is discussed. Comments are grouped by category. The categories are as follows:

1. Comments Concerning License Renewal and its Processes
2. Comments Concerning Water Use and Quality
3. Comments Concerning Socioeconomic Impacts and Environmental Justice
4. Comments Concerning Human Health Issues
5. Comments Concerning Cumulative Impacts
6. Comments Concerning Postulated Accidents
7. Comments Concerning Alternative Energy Sources
8. Comments Concerning Uranium Fuel Cycle and Waste Management

Each comment is summarized in the following pages. For reference, the unique identifier for each comment (Commenter ID letter listed in Table 1) is provided. In those cases where no new environmental information was provided by the commenter, no further evaluation will be performed.

The preparation of the plant-specific supplement to the GEIS, known as a Supplemental Environmental Impact Statement (SEIS), will take into account all the relevant issues raised during the scoping process. The SEIS will address both Category 1 and 2 issues, along with any new information identified as a result of scoping. The SEIS will rely on conclusions supported by information in the GEIS for Category 1 issues, and will include the analysis of Category 2 issues and any new and significant information. The draft plant-specific supplement to the GEIS will be made available for public comment. The comment period will offer the next opportunity for the applicant, interested Federal, State, and local government agencies, local organizations, and members of the public to provide input to the NRC's environmental review process. The comments received on the draft SEIS will be considered in the preparation of the final SEIS. The final SEIS, along with the Staff's Safety Evaluation Report (SER), NRC Region II inspections, and independent review by the Advisory Committee on Reactor Safeguards, will provide basis for the NRC's decision on the Southern Nuclear Operating Company license renewal application.

A.1 Comments and Responses

A.1.1 Comments Concerning License Renewal and Its Processes

Comment: The SRS Community Reuse Organization is a two-state five-county economic development board established by Congress to assist communities surrounding Department of Energy facilities ... We applaud the NRC for holding events such as this meeting and trust that you will diligently consider all input received. Our board has recently expanded our focus to include an interest in commercial nuclear topics, because of the impacts on the community that we serve. (VEGP-C)

Comment: Thank you for letting me speak. Thank you for the opportunity. I'm Dick Byne; I'm on the Waynesboro County Council. I've been to every one of the meetings, I intend to be on as many meetings as you have, if you have 500 between now and then, I'll be at every single one of them. I appreciate the opportunity of living in a free country, to be able to bring concerns. You are open, and you're letting us decide if this is good for our community, and I really do appreciate that. I don't know how many other countries do that, but I know America does, and I appreciate that. I also appreciate the Southern Nuclear going as slow as they are; they're being meticulous about what they're doing. I appreciate that, and I appreciate them being open with everything that they're trying to do, and I appreciate their challenges that they're getting; they're addressing each challenge, and we appreciate that too. And that really means a lot to me. (VEGP-E)

Comment: I have to say that I get a volume of material. I didn't realize how much I'd be receiving, through this process from the NRC, documenting each step of the way of the studies; they are exhaustive. I am convinced they have not overlooked anything in determining whether this will have a bad or a positive impact on our environment. (VEGP-N)

Comment: I want to thank the NRC on behalf of the citizen of Waynesboro who I represent as their Mayor, for having this open, public forum for everyone to express their views, so that they can be taken into account in the decision on whether to renew the license for Plant Vogtle, and to extend the period. (VEGP-N)

Response: *The comments concern the general license renewal process. However, the comments provide no new information related to the Staff's environmental review and, therefore, will not be evaluated further.*

Comment: Good afternoon, everyone. My name is Sara Barczak, and I'm the Safe Energy Director with Southern Alliance for Clean Energy. We are a nonprofit energy policy organization with members throughout Georgia and the region. We promote responsible energy choices that create global-warming solutions and ensure clean, safe and healthy communities in the Southeast. And I'm also a resident of the downstream community of Savannah. The issue of extending the operating life of Plant Vogtle will not affect just this local community but Georgia as a whole, and our regional overall. And we hope the NRC staff understands that we need to do what will benefit all -- not just a select few. (VEGP-A)

Comment: And I know we like to compartmentalize: We're not DOE; we're NRC, we're blah, blah, blah. But the people on the ground are the ones who are getting the benefits or the deficiencies of such major mission. (VEGP-A)

Comment: And given that the license renewal for Vogtle is for 20 additional years of operation—taking us to 2047 and 2049 if approved, we believe the NRC needs to evaluate not only the Georgia of today, but the Georgia we may be living in 40 years from now. (VEGP-A, VEGP-O)

Response: *The comments concern the general license renewal process. The Commission has established a process, by rule, for the environmental and safety reviews to be conducted to review a license renewal application. NRC will evaluate a broad spectrum of potential environmental impacts resulting from the continued operation of Vogtle Units 1 and 2. These findings will be presented in the SEIS.*

Comment: I think it's -- and this is a question directly to what I said earlier in our statements. Is there a process that the NRC has established, given the reality that there are so many more applications and things going on, and new hires, or fairly new, to -- like a license renewal happening within an ESP and then a COL, Early Site Permit and Combined Operating License? Do you have a mechanism within the Agency to get public comment from one entity that may not be reviewed but would be relevant for the COL or the ESP? I mean, the COL hasn't been applied for, but -- (VEGP-A)

Comment: My fear is that there doesn't appear to be any assurance that things won't slip through the cracks, so to speak. We have grave concerns that too many permits are occurring at the same time with Plant Vogtle. A license renewal, an early site permit and an upcoming application for a combined construction and operating license. Can the NRC keep up with all of this in a manner that is truly protective of public health? We are doubtful. As we all know, bureaucracies themselves have their deficiencies. The idea that everything will be coordinated seamlessly between all of these different staffs and projects -- and you know, putting full faith that we have great staff at the NRC. But there's a lot going on, and we're just concerned that these different projects are not going to be integrated, and expecting that to be integrated is somewhat almost unrealistic. But we'd hope that it could happen. (VEGP-A)

Comment: There doesn't appear to be any assurance that things won't slip through the cracks so-to-speak. We have grave concerns that too many permits are occurring at the same time with Plant Vogtle: a license renewal, an early site permit, and an upcoming application for a combined construction and operating license. Can the NRC keep up with all of this in a manner that is truly protective of public health? We are doubtful; as we all know, bureaucracies themselves have their deficiencies. The idea that everything will be coordinated seamlessly between all these different staff and all these different projects seems unrealistic. (VEGP-O)

Response: *The comments are in regard to license renewal and its processes, specifically the concern that issues may "slip through the cracks" with multiple applications concerning VEGP being reviewed by NRC staff at the same time. The Commission has established a process, by rule, for the environmental and safety reviews to be conducted pertaining to a license renewal application. License renewals are being conducted separately, and within another Division within NRC, from the other applications that are currently in progress, such as an Early Site Permit application. To address this specific issue, as well as other related issues, NRC has developed protocol to help ensure the consistent application of technical and regulatory* *guidance by the Offices of Nuclear Reactor Regulation (NRR) and New Reactors (NRO). In Chapter 4 of the draft SEIS, NRC staff will consider potential cumulative impacts on the environment resulting from the incremental impact of license renewal when added to other past, present, and reasonably foreseeable future actions, including the construction and operation of two additional reactors at the VEGP site.*

Comment: Please see attached public comments from October 4, 2007 public meeting. Due to time limitations at that meeting, only a small portion was read into the record. We feel that these comments are pertinent to the Vogtle relicensing process and request that they be reviewed.

Response: *The references comments have been incorporated into the public record and are accessible through ADAMS Accession Number ML073060040. The specific comments are addressed in this document in the appropriate technical sections.*

A.1.2 Comments Concerning Water Use and Quality

Comment: Power plants have a tremendous impact on our water resources. Our energy choices do make a big difference in the future of the river basins and the communities and businesses relying on those water resources. (VEGP-A)

Comment: Most people are not aware that the nuclear plants in Georgia have larger water permits than most municipalities, including nearby Augusta. Plant Vogtle is currently the largest water user in the entire Savannah River Basin, and has an average withdrawal of 64 million gallons per day from the Savannah River, with an average consumption of 43 million gallons per day. That means that Vogtle is returning only about a third of what it withdraws from the River. An additional 20 years of operation as populations increase and the demand for water increases will not be a positive development for our water resources.

That was released earlier this month, actually after this application was submitted. While I have not yet had time to read the draft EIS word for word that we're going to talk about next Thursday, but I can tell you that it appears that the cumulative impact on water quality and quantity have not been satisfactorily evaluated in the draft EIS for the early site permit. And that's a problem, because this early license renewal is saying that that's going to be a draft in the early site permit, and I don't see it there, so it's a concern. (VEGP-A)

Comment: And I'm interested in the amount of extract of water from the river, for the use of the plant not exceed that. It's going to be used for those farmers along the river, as well as those who would like to use it as a recreation facility. And so I -- my primary interest in that part of it at this time, because if it's not addressed, that young man or that young lady who would like to just go strolling down the river, are we going to pull out more than a power boat would able to even go down, and enjoy it. There's only one river; there's only one provider. And let us use it for the best that we can use it for and not put those farmers who are using it for irrigation -- put them out of business. So let us look at what we can return to the river, as safe, usable water, because once it's gone, it's gone, and we can't replenish it. So that's my thinking, that's my goal, is to make sure that the little man like I am, is taken care of, in any type of restructuring, redevelopment. And thank you very much. (VEGP-I)

Comment: The State of Georgia and surrounding states are currently facing a drought of epic proportions, and there does not appear to be any analysis of the current situation in the application nor analysis beyond a level 3 drought. Plant Vogtle is the largest water user in the entire Savannah River basin and has an average withdrawal of 64 million gallons per day from the Savannah River and an average water consumption of 43 million gallons per day. That means that Vogtle is returning only about one-third of what it withdraws from the Savannah River. An additional 20 years of operation, as populations increase, will not be a positive development for our water resources. (VEGP-O)

Comment: Power plants have a tremendous impact on our water resources. Our energy choices make a big difference on the future of the river basins and the communities and businesses reliant on those water sources. (VEGP-O)

Response: *The comments are related to water use conflicts specific to VEGP. Water use conflict is a Category 2 issue and will be addressed in Chapters 2 and 4 of the SEIS.*

Comment: Lastly, as a downstream resident I'm very concerned about tritium, a radioactive form of hydrogen that can impact our health. Faced with saltwater intrusion of the Floridan Aquifer, both Beaufort and Jasper Counties in South Carolina and the Savannah area will become more dependent on the Savannah River for drinking water. I did not see that discussed in the application. Plant Vogtle already contributes to the tritium in the River, although they are not the major culprit; and allowing the reactors to operate for longer will do nothing to reduce this reality, let alone when and if more reactors come online. The NRC needs to study tritium in the river, future projections, especially given the Savannah River Site's already large contribution to the tritium pollution, and to analyze this with droughts and future population growth in mind. The future safety of not only this community, but many, many, others are at stake. (VEGP-A)

Comment: There are concerns about tritium contamination, a radioactive form of hydrogen that can impact our health. Faced with saltwater intrusion of the Floridan Aquifer, both Beaufort and Jasper counties in South Carolina and the Savannah area will become more dependent on the Savannah River for drinking water. Plant Vogtle already contributes to the tritium in the river and allowing the reactors to operate for longer will do nothing to reduce this reality, let alone when and if more reactors come online. The NRC needs to study tritium in the river, future projections especially given the Savannah River Site's already large contribution to the tritium pollution, and to analyze this with droughts and future population growth in mind. (VEGP-O)

Response: *The comments are noted and relate to both human health and water use conflicts associated with continued operation of Plant Vogtle. Human health issues were evaluated in the GEIS and were determined to be Category 1 issues. The GEIS evaluated radiation exposures to the public for all plants including VEGP, and concluded that the impact was small. During the plant-specific environmental review of VEGP, the NRC will determine whether there is any new and significant information bearing on the previous analysis in the GEIS. The information provided by the comments will be reviewed as part of that determination. In addition, evaluation of new studies and analyses of the health effects of radiation exposure is an ongoing effort at the NRC. Water use conflict is a Category 2 issue and will be addressed in Chapters 2 and 4 of the SEIS.*

Comment: Additionally, since we are discussing the prospects of these reactors operating for many decades from now, the NRC needs to evaluate predictive effects of global warming on this region, and how nuclear power plants may be negatively impacted or unable to generate electricity. This was demonstrated, as many of us in the room know, by the heat wave this past summer in Europe, when nuclear power plants from Sweden to France had to shut down because of the lake -- I'm sorry -- the summer of 2006, when nuclear power plants from Sweden to France had to shut down because the lake or river water temperatures were too high. (VEGP-A, VEGP-O)

Response: *The comments pertain to an extended heat wave in Europe in July of 2006. Drought conditions, associated with the heat wave, contributed to reduced water levels in the lakes and rivers that some nuclear plants use to cool their reactors. As a result, some plants in France, Spain, and Germany were taken offline and operations were reduced at others. Across Western Europe, nuclear plants also had to obtain exemptions from regulations in order to discharge overheated water into the environment. This is an example of a potential water use conflict that could be associated with plants with cooling pond or cooling towers using make-up water from a small river with low flow. Water use conflict is a Category 2 issue and will be addressed in Chapters 2 and 4 of the SEIS.*

A.1.3 Comments Concerning Socioeconomic Impacts and Environmental Justice

Comment: Plant Vogtle is a project that will be an economic engine for Burke County and the entire CSRA. The Burke County Plant Vogtle plant is one of the best-run plants in the United States of America. It has an impeccable safety record, and it is run very, very efficiently, and it is run very, very well. I would like to tell each and every one of you here tonight that an economic boost in Burke County is something that we need. An economic boost in the CSRA is something that we also need. We've lost many jobs in Burke County, Jenkins County, and in Richmond County. And we need to do everything that we can to try to create the job buildup which Plant Vogtle will do for us all. (VEGP-L)

Response: *The comment is noted. Socioeconomic issues specific to the plant are Category 2 issues and will be discussed in Chapter 4 of the SEIS.*

Comment: Good evening. Just wanted to say that I'm primarily interested in environmental justice in this area. I've been working with communities throughout the country and most of those are EJ communities. (VEGP-I)

Response: *To perform a review of environmental justice in the vicinity of the nuclear power plant, the NRC staff examines the geographic distribution of minority and low-income populations within 50 miles (80 km) of the site being evaluated. The Staff uses the most recent census data available. Once the locations of minority and low-income populations are identified, the Staff determines the extent to which these populations may be disproportionately affected. The comments are noted. Environmental justice is an issue specific to the plant and will be addressed in Chapter 4 of the SEIS.*

A.1.4 Comments Concerning Human Health Issues

Comment: As you know, there's been a controversial health study that's put out, but one of the things that the National Cancer Study did note that in Aiken, Barnwell, Burke County, the cancer rates before the startup of Vogtle were less than 26 percent of the rest of the country. And the most recent, from '99 to 2003, shows Burke County with an 11 percent increase over the rest of the country. I'm not saying, again, just like the tobacco industry, why this is happening. But I would put it in your laps that we really should have and support with our federal dollars an independent study that we can all agree upon, really takes a look at the burden of impact of this. (VEGP-G)

Response: *The GEIS evaluated human health issues and determined them to be a Category 1 issue. However, the cited reference will be reviewed to determine whether there is any new and significant information relative to VEGP.*

A.1.5 Comments Concerning Cumulative Impacts

Comment: Further, the proposed new reactors at Plant Vogtle are estimated to use over 50 million gallons of water per day, with 50 to 75 percent of that lost as steam, and that's from Southern Nuclear's August 2006 application. This means that more water will be lost from the two existing and two proposed reactors at Plant Vogtle than is currently used by all residents of Atlanta, Augusta, and Savannah combined. Yet the application doesn't discuss the cumulative impacts of the existing and proposed reactors. Instead, it says in Section 2.12.3 that the NRC will do such an analysis in the draft EIS for the early site permit. (VEGP-A)

Comment: Further, the proposed new nuclear reactors at Plant Vogtle are estimated to use 53 million gallons of water per day with 50-75% of that lost as steam. (Southern Nuclear Operating Company, Early Site Permit Application, Environmental Report, August 2006). This means that more water will be lost from the two existing and two proposed reactors at Plant Vogtle than is currently used by all residents of Atlanta, Augusta, and Savannah combined. Yet, the application doesn't discuss the cumulative impacts of the existing and proposed reactors. Instead, it says in section 2.12.3 that the NRC will do such an analysis in the draft EIS for the Vogtle ESP that was released earlier in September, actually after this license renewal application was submitted. From our review of the draft EIS for the ESP at Vogtle, the cumulative impacts on water quality and quantity have not been satisfactorily evaluated. Therefore, we believe that this issue is also deficient in terms of the license renewal evaluation. (VEGP-O)

Comment: For instance, section 2.12.3 of Southern's license renewal application states that the NRC will do a cumulative water analysis in this draft EIS for the early site permit. Well, I can tell you that it appears that the cumulative impacts on water quality and quantity have not been satisfactorily evaluated in the draft EIS for the early site permit. That is a problem. (VEGP-O)

Comment: The NRC should not make its decisions or evaluations in a vacuum. If the two new reactors are approved and actually built, the existing two reactors will be operating at the same time, and this application and all other applications associated with Plant Vogtle have to address the cumulative impacts -- not pass the buck, assuming that some other committee within the NRC working on some other project is going to cover it. (VEGP-A, VEGP-O)

Comment: Hello. I guess I'm addressing mainly you here. My name is Bobbie Paul ... One of the things that I think is -- should be considered seriously is a calculation of the overall impact to the region, of the many nuclear activities that are going on in this region. Very often we -- I myself have stayed away from the nuclear power arena until the new reactors were proposed, thinking we had enough to deal with at Savannah River Site. But because of the waste, because of the terrorist activities and potential, because of the health issues and the consequences, latent cancers -- I am a doctor's daughter; I've become more and more concerned about all of this. And as you probably know, although I do find that sometimes as

Sara said, there's a lot of disjointed where people are kind of working in a vacuum. But it reminds me of the arcade game where the little guy keeps popping his head up and you keep trying to bat it down. I feel like there are nuclear things popping all over this region, and as we know, this is the most radioactive region, this 15-mile area, in the whole country; not for volume, but for radioactivity.

So right now I guess as people in the audience are probably full aware the Savannah River Site is now the recipient, continually will be the recipient, of more plutonium from Hanford, from Lawrence Livermore in California, and Los Alamos in New Mexico. This has an impact on the region, not only from transportation but other things. We also have active tritium extraction going on at Savannah River Site, and added to that now we're having the likelihood of -- well, I hope not the likelihood of two new reactors, which may disappoint people in the room, and I do understand what an economic treasure Plant Vogtle has been to this area, because I have many friends who live in this area. But I sincerely think that that cumulative burden that's really being put on the people in this 40- to 50-mile radius of this should be considered, whether it's an independent study or what. (VEGP-G)

Comment: So as we look at anything that's going to impact our river, and the use of it now from Augusta down, we know we have Olin Chemicals as well as Federal Paper, and others who are pulling from the river constantly. (VEGP-I)

Response: *As part of the environmental review process, the NRC evaluates the potential for cumulative impacts of operations (as defined in 40 CFR 1508.7) during the renewal term. In Chapter 4 of the SEIS, the impacts of the proposed action will analyzed in conjunction with other past, present, and reasonably foreseeable future actions at VEGP, including the cumulative impacts associated with the proposed addition of Units 3 and 4, and the activities of other industrial facilities and/or Federal agencies, such as the Department of Energy at Savannah River Site.*

Comment: We have strong concerns about the NRC's analysis on the impacts Vogtle's proposed expansion would have on our water resources. Our energy choices make a big difference on the future of the river basins and the communities and businesses reliant on those water sources. Vogtle is the largest water user in the Savannah River basin and its expansion essentially doubles that water use and water loss. We would suggest to the NRC that water use should be reported in different ways to help people actually understand the numbers. For instance, in Section 7.3, water consumption is reported in cubic feet per second. Though I did the math, I don't think most people have the time to convert all of those figures to gallons per day, which is what most of our surface water withdrawal permits in Georgia are licensed under. When you do the math, it shows that the current reactors are losing ~43 million gallons of water per day and that the new reactors will lose ~40 mgd. This means that more water will be lost from the two existing and two proposed reactors at Plant Vogtle than is currently used by all residents of Atlanta, Augusta, and Savannah combined. And on p. 2-34, the draft EIS says that Burke County is projected to have a 50% increase in water demand by 2035 and that neighboring South Carolina's water demand will also increase by 50% from 2000-2045 and acknowledges that people will be shifting off of the Floridan Aquifer to the Savannah River and simply states that all of this would also increase demands for Savannah River water downstream of Vogtle. But in the end, because the NRC calculated that the two new reactors would not decrease the Savannah River flow of today by more than 5%, it acts as though all is good. Well, nowhere in this document does it appear that the NRC has evaluated how the Savannah River is going to be able to handle the Georgia and South Carolina that we will live in decades from now, that by the NRC's own statements appears to be a future in which the Savannah River is going to see extreme increases in demand. Further, the draft EIS has no analysis of climate change predictions on our water systems, such as the prospects for severe, long-lasting mega-droughts, of which Georgia may encounter as global warming impacts are realized. Again we ask, who stands to gain and who stands to lose? (VEGP-O)

Comment: Sure, you are going to hear all the local economic boosters come out in numbers to say the existing reactors generate revenue and jobs. You will hear folks who live here say how Southern is the biggest employer in Burke County and you will see Table 2-16 show that Southern pays over 80% of the property taxes in the county and that Burke County has one of the highest revenues in the state. And you'll hear the company make it look like a full assessment of the cumulative impacts related to socioeconomics has been done where it states on page 7-17 that, "In terms of beneficial effects including tax revenues benefits, the impacts on Burke County would be large."

But where's the analysis and the NRC review of the cumulative impacts for ratepayers in Georgia who face serious harm from potential adverse impacts down the road? Isn't that part of the socio-economic impact on all of us? Who's doing any analysis on the implications of the Southern Company proposal included in its application to have the new radioactive waste it will generate go to a fictitious federal waste repository? A repository that doesn't even exist and that ratepayers have been paying for over many years and that states have been forced to sue the federal government on that translates into ratepayer dollars. NRC largely ignores this reality in its review of Vogtle's proposal. But you can know that ratepayers and state agencies and the public would think that surely the NRC as the federal agency charged to oversee a review would have fully addressed this issue in reviewing a new reactor proposal. (VEGP-O)

Response: *The comments are noted. The comments are specific to the Draft EIS that was prepared for the Early Site Permit (ESP) associated with the proposed new reactors at Plant Vogtle (Units 3 and 4) and published for public review and comment. The cumulative impacts associated with the operation of two additional reactors at Plant Vogtle will be addressed in Chapter 4 of the SEIS produced as part of the Staff's license renewal environmental review.*

A.1.6 Comments Concerning Postulated Accidents

Comment: And that leads me to the last thing and back to my friends here in Burke County. How are we communicating with the folks on the ground here? Let's do a worst-case scenario. Even from a business standpoint, I realize Southern Company is a business and has to make a profit. Let's look at a worst-case scenario. Don't we owe it to the people here in Burke County to show what would happen in the worst possible case, if there was a meltdown, if there was a valve like there was at Farley in Alabama that didn't quite work right. (VEGP-G)

Comment: But I think it's time for us to stop downplaying all of the risks of nuclear. We all know that radiation kills. That's a known fact. I'm not being hysterical about that. But let's look at the worst case and then move from there, forward together. Thank you. (VEGP-G)

Response: *The environmental review considers postulated plant accidents that might occur during the license renewal term. It also includes a review of the alternatives to mitigate severe accidents if this has not previously been evaluated for the applicant's plant. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified, evaluated, and, if appropriate, implemented. The impacts of postulated accidents are considered within the scope of the environmental review for license renewal and will be addressed in Chapter 5 of the SEIS.*

A.1.7 Comments Concerning Alternative Energy Sources

Comment: The application is deficient in its analysis of energy sources efficiency. Energy efficiency and conservation represent the quickest, safest, cheapest way to provide more power and to best protect our air and water resources. As an added benefit, increased energy efficiency reduces water consumption by power plants that compete with local industries and cities for much-needed water. The NRC should be aware that in 2001, the Energy Information Administration ranked Georgia eighth in the nation for per capita energy consumption for electricity, and 40th in per capita spending on energy efficiency programs. (VEGP-A, VEGP-O)

Comment: The NRC needs to fully research other energy choices, including energy efficiency and conservation, as the application from Southern Nuclear is woefully inadequate. Renewable energy supplies are available here in Georgia, such as biopower, solar and wind. In fact, according to a 2006 report from the Georgia Environmental Facilities Authority, Georgia has the potential to meet 1500 to 1600-plus megawatts of the state's forecasted electricity demand through new, renewable resources, from biomass, wind, hydropower, landfill gas, and solar photovoltaics. These energy supplies should be supported due in part because they keep dollars here at home, and they don't pose the risk to the community that nuclear power does. (VEGP-A) (VEGP-O)

Comment: The NRC should be aware that new, certified wind maps of Georgia were released by the National Renewable Energy Laboratory in October 2006 that show there is substantial wind power available, especially offshore, with a potential of 10,000MW. Go to the Georgia Wind Working Group website at www.gawwg.org. Yet information in the application is completely outdated; in terms of wind it referenced 1986 data in spite of Southern Company being involved in a an offshore wind study with Georgia Tech that was released in part earlier this summer. Additionally, the potential to use Georgia's plentiful agriculture and forestry resources should be evaluated. A conservative estimate from a University of Georgia study showed that as much as 12% of Georgia's total electricity demand could be generated from biomass. The benefits to Georgia include increased self-sufficiency, improved water resource quality, and long-term environmental and rural development benefits. (VEGP-A) (VEGP-O)

Comment: The NRC should be aware that new, certified wind maps of Georgia were released by the National Renewable Energy Laboratory in October 2006 that show there is substantial wind power available, especially offshore, with a potential of well over 10,000 MW. Go to the Georgia Wind Working Group website at www.gawwg.org for background. Yet Section 9.2.3.2 on wind power doesn't mention this potential, instead relying on Southern's slanted wording of a study they did with Georgia Tech that "technology limitations and regulatory restrictions would make development of offshore wind projects difficult in the southeast." Instead of taking Southern's word for it, the NRC should actually review the offshore wind study with Georgia Tech that was released in part earlier this summer and is now finalized ready for release. (VEGP-O)

Comment: The analysis of energy efficiency is deficient. This issue is still under review by the Georgia PSC as a result of analytical questions that arose in reviewing Georgia Power's Integrated Resource Plan this year. The PSC has ordered a working group to examine these issues further. Energy efficiency and conservation represent the quickest, safest, cheapest way to provide more power and to best protect our air and water resources. As an added benefit, increased energy efficiency reduces water consumption by power plants that compete with local industries and cities for much needed water. The NRC should be aware that in 2001, the Energy Information Administration ranked Georgia 8th in the nation for per capita energy consumption for electricity and 40th in per capita spending on energy efficiency programs. Additionally, we are an energy exporting state. We use our natural resources, impact our citizens' health, and pile up nuclear waste within our border to power other states' air conditioning units. (VEGP-O)

Comment: Additionally, the potential to use Georgia's plentiful agriculture and forestry resources should be more closely evaluated as the benefits include increased self-sufficiency, improved water resource quality, and long-term environmental and rural development benefits. A University of Georgia 2003 study that showed that as much as 12% of Georgia's total electricity demand could be generated from biomass was referenced by the NRC in Section

9.2.3.8, but the NRC dismissed biomass as not being economically competitive with existing technologies. Georgia Power's plan filed with the Georgia PSC this year shows there are competitive biomass projects. Further, nowhere in this draft EIS does it state officially how much these new reactors are going to cost Georgia ratepayers or taxpayers, instead providing estimates on p. 5-38 ranging from $1.2-2.6 billion for each reactor. (VEGP-O)

Response: *The comments are related to the alternatives to license renewal at VEGP. The GEIS included a discussion of alternative energy sources. Environmental impacts associated with various reasonable alternatives to renewal of the VEGP operating license, including renewable energy sources and conservation (Demand-Side Management), will be evaluated in Chapter 8 of the SEIS.*

Comment: The draft EIS failed to fully research other energy choices, including energy efficiency and conservation. Renewable energy supplies are available here in Georgia, such as biopower, solar, and wind. In fact, according a 2006 report by the Georgia Environmental Facilities Authority, Georgia has the potential to meet 1518-1618 MW of the state's forecasted electricity demand through new renewable resources from biomass, wind, hydropower, landfill gas, and solar photovoltaics. (Meeting Future Electricity Demand, GA Environmental Facilities Authority, 2006). These energy supplies should be tapped because they keep dollars here at home, provide safe jobs, and don't pose the risks to the community that nuclear power does. (VEGP-O)

Response: *The comments are noted. The comments are specific to the Draft EIS that was prepared for the Early Site Permit (ESP) associated with the proposed new reactors at Plant Vogtle (Units 3 and 4) and published for public review and comment. However, these comments will be considered during the preparation of the SEIS for license renewal. Environmental impacts associated with various reasonable alternatives to renewal of the VEGP operating license, including renewable energy sources and conservation (Demand-Side Management), will be evaluated in Chapter 8 of the SEIS.*

A.1.8 Comments Concerning Uranium Fuel Cycle and Waste Management

Comment: My next-to-last point would be waste. We have no solution for the waste. Yucca Mountain is likely not to be built. If it was, the transportation risks and everything else are terrific. There was just a little earthquake tremor out in Yucca Mountain in Nevada the other day. (VEGP-G)

Response: *Onsite storage of spent nuclear fuel is a Category 1 issue. The safety and environmental effects of long-term storage of spent fuel onsite has been evaluated by the NRC, as set forth in the Waste Confidence Rule. The NRC's Waste Confidence Rule, found in 10 CFR 51.23, states: The Commission has made a generic determination that, if necessary, spent* *fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time. In its Statement of Considerations for the 1990 update of the Waste Confidence Rule (55 FR 38472), the Commission addressed the impacts of the disposal of spent fuel discharged from the current fleet of reactors operating under existing and renewed licenses and from a new generation of operating reactors. The rule was last reviewed by the Commission in 1999 when it reaffirmed the findings in the rule (64 FR 68005, dated December 6, 1999). The comments provide no new and significant information relevant to the Staff's environmental review and, therefore, will not be evaluated further.*

Comment: I know they're talking about GNEP, and I was interesting -- interested to hear the man from Savannah River Site say, we're looking at energy. I know the global nuclear energy partnership coming down the pike for the last two years has all of these indications that there's going to be a hope for getting rid of some of this waste through a return to reprocessing. This is one of the most filthy, dangerous plutonium cycles that we could ever engage in, and will create more waste. This spent fuel and these rods that come out that have to sit in cooling ponds are highly radioactive and have to sit in these ponds for five years before we can even deal with them. (VEGP-G)

Response: *The comments are related to the uranium fuel cycle and waste management issues. Uranium fuel cycle and waste management issues were evaluated in the GEIS and were determined to be Category 1 issues. The Global Nuclear Energy Partnership is not the subject of this environmental review, and the comment does not provide any new and significant information that would alter the original GEIS determinations regarding the uranium fuel cycle. However, as part of the environmental review process, the NRC evaluates the potential for cumulative impacts of operations (as defined in 40 CFR 1508.7) during the renewal term. In Chapter 2 of the SEIS, the NRC will review the possibility that activities of other Federal agencies, such as the Department of Energy at Savannah River Site, contribute to cumulative impacts in conjunction with license renewal. In Chapter 4 of the SEIS, the impacts of the proposed action will be combined with other past, present, and reasonably foreseeable future actions at VEGP.*

Appendix B

Contributors to the Supplement

Appendix B

Contributors to the Supplement

The overall responsibility for the preparation of this supplement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations, Earth Tech, Inc. and Pacific Northwest National Laboratory.

Name	Function or Expertise
Nuclear Regulatory Commission	
Justin Leous	Environmental Project Manager/Alternatives
Louise Lund	Branch Chief
Dennis Beissel	Technical Monitor/Hydrology
Nathan Goodman	Terrestrial Ecology
Elizabeth Wexler	Aquatic Ecology
Jeffrey Rikhoff	Cultural Resources/Socioeconomics/Land Use
Steve Klementowicz	Radiation Protection
Andrew Carrera	Radiation Protection
Robert Palla	Severe Accident Mitigation Alternatives
Earth Tech	
Roberta Hurley	Project Manager
John Szeligowski	Alternatives
Stephen Dillard	Lead Ecologist/Aquatic and Terrestrial Ecology
Susan Provenzano, AICP	Land Use/Socioeconomics
Matt Goodwin	Cultural Resources
Robert Dover, PG	Hydrology/Water Quality
Ed Kaczmarczyk	Air Quality
Katie Broom	Project Coordinator
Monique Thomas	Technical Editor
Bonnie Freeman	Administrative Support
Pacific Northwest National Laboratory	
Steve Short	Severe Accident Mitigation Alternatives
Tye Blackburn	Severe Accident Mitigation Alternatives
Bruce Schmitt	Severe Accident Mitigation Alternatives

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Southern Nuclear Operating Company Application for License Renewal of Vogtle Electric Generating Plant, Units 1 and 2

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Southern Nuclear Operating Company Application for License Renewal of Vogtle Electric Generating Plant Units 1 and 2

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Southern Nuclear Operating Company (SNC), and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 51, of SNC's application for renewal of the Vogtle Electric Generating Plant, Units 1 and 2, (VEGP) operating license. The License Renewal Application and the Draft Supplement Environmental Impact Statement (SEIS) have been placed in the Burke County Library, at 130 Highway 24 South, Waynesboro, GA 30830. All documents, with the exception of those containing proprietary information, are available electronically from the Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the publicly available records component of ADAMS. The ADAMS accession number for each document is included below.

January 9, 2007	Letter from Robert E. Martin, NRC, to Mr. D.E. Grissette, Southern Nuclear Operating Company, Inc., Regarding Vogtle Electric Generating Plant Unit 2 Exemption from the Requirements of 10 CFR Part 54, Section 54.17(c), for the License Renewal Application. (ADAMS Accession No. ML062770492).
June 27, 2007	Letter from L.M. Stinson, Southern Nuclear Operating Company, Inc., to NRC submitting the application for the renewal of the operating licenses for Vogtle Electric Generating Plant. (ADAMS Accession Nos. ML071840351 [Cover Letter], ML071840360 [Application], and ML071840357 [Environmental Report]).
July 10, 2007	Letter from J.P. Leous, NRC, to Ms. Elaine M. Sikes, Burke County Library, Regarding Maintenance of Reference Materials Related to the Review of the Vogtle Electric Generating Plant Units 1 and 2 License Renewal Application at the Burke County Library. (ADAMS Accession No. ML071860391).
August 3, 2007	Federal Register Notice of Receipt and Availability of Application for Renewal of Vogtle Electric Generating Plant, Units 1 and 2 Facility Operating License Nos. NPF-68 and NPF-81 for an Additional 20-Year Period (72FR43296). (ADAMS Accession No. ML071840090).

August 21, 2007	Federal Register Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License Nos. NPF-68 and NPF-81 for an Additional 10-Year Period, Docket Nos. 50-424 and 50-425 (72FRN46680). (ADAMS Accession No. ML072130084).
August 21, 2007	Letter from Rani Franovich, NRC, to Mr. Tom E. Tynan, Vice President Vogtle Electric Generating Plant, Regarding Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Vogtle Electric Generating Plant, Units 1 and 2. (ADAMS Accession No. ML072140293).
August 5, 2007	Letter from J.P. Leous, NRC, to Mr. Tom E. Tynan, Vice President Vogtle Electric Generating Plant, Regarding Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072400136).
August 22, 2007	Letter from Rani Franovich, NRC, to Mr. David Bernhart, National Marine Fisheries Service, Regarding Request for a List of Protected Species and Essential Fish Habitat Within the Area under Evaluation for the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application Review. (ADAMS Accession No. ML072060605).
August 22, 2007	Letter from Rani Franovich, NRC, to Mr. Strant Colwell, U.S. Fish and Wildlife Service, Regarding Request for a List of Protected Species Within the Area under Evaluation for the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application Review. (ADAMS Accession No. ML072040219).
August 22, 2007	Letter from Rani Franovich, NRC, to Mr. Don L. Kilma, Advisory Council on Historic Preservation, Regarding Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072060568).
August 22, 2007	Letter from Rani Franovich, NRC, to Dr. Ray Luce, Historical Preservation Division, Georgia Department of Natural Resources, Regarding Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072060519).
August 28, 2007	Federal Register Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Vogtle Electric Generating Units 1 and 2, Docket Nos. 50-424 and 50-425 (72FRN49322). (ADAMS Accession No. ML072140337).

August 31, 2007	Letter from Rani Franovich, NRC, to Mr. James Caulder, Chief The Pee Dee Tribe of South Carolina, Regarding Request for Comments Concerning Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210551).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. James Webb, Chief The Waccamaw Indian People, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210590).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Pare Bowlegs, Seminole Nation of Oklahoma, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Unit 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210746).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. A.D. Ellis, Principal Chief Muscogee (Creek) Nation, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210286).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Louis McGertt, Thlopthlocco Tribal Town, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211012).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Gale Thrower, NAGPRA Contact Poarch Band of Creek Indians, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211016).
August 31, 2007	Letter from Rani Franovich, NRC, to The Lower Muscogee Creek Tribe Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211004).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Emma Sue Holland, NAGPRA Contact United Keetoowah Band of Cherokee Indians, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211008).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Richard L. Allen, NAGPRA Contact Cherokee Nation of Oklahoma, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210861).

August 31, 2007	Letter from Rani Franovich, NRC, to The Eastern Cherokee, Southern Iroquois and United Tribes of South Carolina Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210646).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Roosevelt Scott, Chief The Santee Indian Organization, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210347).
August 31, 2007	Letter from Rani Franovich, NRC, to The Cherokee of Georgia Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072070113).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Gilbert Blue, Chief Catawba Indian Nation, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072070691).
August 31, 2007	Letter from Rani Franovich, NRC, to Chief Louie Chavis, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211003).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Eddie Tullis, Chairperson Poarch Band of Creek Indians, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211013).
August 31, 2007	Letter from Rani Franovich, NRC, to The Wasaamasaw Tribe of Varnertown Indians Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210744).
August 31, 2007	Letter from Rani Franovich, NRC, to Chief Gene Norris, The Piedmont American Indian Association, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210315).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Carolyn Chavis Bolton, Chief The Pee Dee Indian Nation of Upper South Carolina, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210375).

August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Debbie Thomas, Tribal Historic Preservation Officer, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210817).
August 31, 2007	Letter from Rani Franovich, NRC, to The American Indian Chamber of Commerce of South Carolina Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210901).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. John Zachary, Attorney at Law c/o Coushatta Tribe of Louisiana, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210880).
August 31, 2007	Letter from Rani Franovich, NRC, to The Honorable Ms. Evelyn Bucktrot, Town King Kialegee Tribal Town, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210575).
August 31, 20007	Letter from Rani Franovich, NRC, to Mr. Kenneth H. Carleton, THPO/Tribal Archaeologist, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210373).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Bill Anoatubby, Governor Chickasaw Nation, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210312).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Steven Terry, Land Resources Manager Miccosukee Tribe of Indians of Florida, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210294).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Dallas Proctor, Chief United Keetoowah Band of Cherokee Indians, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210950).
August 31, 2007	Letter from Rani Franovich, NRC, to Vernon Tanner, Chief The Chaloklowa Chickasaw Indian People, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210338).

August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Willard Steele, Deputy THPO Seminole Tribe of Florida, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210633).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Karen Kaniatobe, Director of the Cultural/Historical Preservation Department Absentee-Shawnee Tribe of Oklahoma, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072211009).
August 31, 2007	Letter from Rani Franovich, NRC, to Mrs. Joyce A. Bear, NAGPRA Contact Muscogee (Creek) Nation of Oklahoma, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210668).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Kathy McCoy, NAGPRA Contact Eastern Band of Cherokee Indians, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210498).
August 31, 2007	Letter from Rani Franovich, NRC, to Georgia Tribe of Eastern Cherokee Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210937).
August 31, 2007	Letter from Rani Franovich, NRC, to Mr. Charles Thurmond, NAGPRA Contact, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210364).
August 31, 2007	Letter from Rani Franovich, NRC, to Ms. Virginia Nail, NAGPRA Contact, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072210995).
August 31, 2007	Letter from Rani Franovich, NRC, to The American Cherokee Confederacy, Inc. Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072140791).
September 5, 2007	Letter from J.P. Leous, NRC, to Mr. Tom Tynan, Vogtle Electric Generating Plant, Regarding Environmental Site Audidt Regarding Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application (ADAMS Accession No. ML072400136).

September 11, 2007	Letter from David Bernhart, NOAA, to Rani Franovich, NRC, Response to NRC letter dated August 22, 2007 Regarding Renewal of Operating Licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) in Burke County. (ADAMS Accession No. ML072670546).
October 3, 2007	Email from Steve Terry, Miccosukee Tribe, to NRC Vogtle License Renewal website, Regarding Request for Comments Concerning the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML0728405172).
October 12, 2007	Letter from J.P. Leous, NRC, to Southern Nuclear Operating Company, Inc. Regarding Summary of Public Environmental Scoping Meetings Related to the Review of the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Applications. (ADAMS Accession No. ML072840963).
October 23, 2007	Email from J.P. Leous, NRC, to Dale Fulton and Tom Moorer, Southern Company, Regarding Vogtle Environmental Site Audit Follow Up. (ADAMS Accession No. ML073040040).
October 24, 2007	Letter from J.P. Leous, NRC, to Mr. Tom Tynan, Vogtle Electric Generating Plant, Regarding Request for Additional Information Regarding Severe Accident Mitigation Alternatives for Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application. (ADAMS Accession No. ML072841107).
November 6, 2007	Letter from Tom Tynan, Southern Nuclear Operating Company, Inc., to NRC, Regarding Vogtle Early Site Permit Application, Response to Request for Additional Information Involving Quality Assurance Controls for Limited Work Authorization-2. (ADAMS Accession No. ML073120135).
November 12, 2007	Letter from Tom Tynan, Southern Nuclear Operating Company, Inc., to NRC, Regarding Vogtle License Renewal Application, Environmental Site Audit Information Request – Follow up Response. (ADAMS Accession No. ML073300604).
November 16, 2007	Letter from J.P. Leous, NRC, Regarding Summary of Conference Call with Southern Nuclear Operating Company, Inc. to Discuss the Severe Accident Mitigation Alternatives Requests for Additional Information for Vogtle Electric Generating Plant, Units 1 and 2 (ADAMS Accession No. ML073120119).
November 19, 2007	Letter from J.P. Leous, NRC, to Southern Nuclear Operating Company, Inc., Regarding Summary of Site Audit Related to the Review of the License Renewal Application for Vogtle Electric Generating Plant, Units 1 and 2. (ADAMS Accession No. ML073111213).

December 5, 2007	Email from Karen Kaniatobe, THPO Absentee Shawnee Tribe, to the NRC Regarding GA/No Properties Identified/Vogtle Electric Generating Plant, Units 1 & 2. (ADAMS Accession No. ML073520077).
December 13, 2007	Letter from Rhianna Rogers, THPO Seminole Tribe of Florida, to J. P. Leous, NRC, Regarding Archaeological Report: Vogtle Electric Generating Plant. (ADAMS Accession No. ML080040114).
February 1, 2008	Letter from Tom Tynan, Southern Nuclear Operating Company, Inc., to the NRC Regarding Vogtle License Renewal Application, Follow Up to Severe Accident Mitigation Alternatives, Request for Additional Information, Review Questions. (ADAMS Accession No. ML080360158).
February 11, 2008	Letter from J.P. Leous, NRC, to Southern Nuclear Operating Company, Inc. Regarding Summary of Conference Call with Southern Nuclear Operating Company, Inc. to Discuss the Severe Accident Mitigation Alternatives Request for Additional Information Applicant Responses for Vogtle Electric Generating Plant, Units 1 and 2. (ADAMS Accession No. ML080240172).

Appendix D

Organizations Contacted

Appendix D

Organizations Contacted

During the course of the Staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, local, and Native American tribal agencies were contacted:

Advisory Council on Historic Preservation

National Marine Fisheries Service

U.S. Fish and Wildlife Service

U.S. Environmental Protection Agency, Region IV

Georgia Department of Natural Resources, Environmental Protection Division

Georgia Department of Natural Resources, Historical Preservation Division

The Pee Dee Tribe of South Carolina

The Waccamaw Indian People

Seminole Nation of Oklahoma

Muscogee (Creek) Nation

Thlopthlocco Tribal Town

Poarch Band of Creek Indians

The Lower Muscogee Creek Tribe

United Keetoowah Band of Cherokee Indians

Cherokee Nation of Oklahoma

Eastern Cherokee, Southern Iroquois and United Tribes of South Carolina

The Santee Indian Organization

The Cherokee of Georgia

Catawba Indian Nation

The Beaver Creek Indians

The Wasaamasaw Tribe of Varnertown Indians

The Piedmont American Indian Association

The Pee Dee Indian Nation of Upper South Carolina

Alabama-Coushatta Tribe of Texas

The American Indian Chamber of Commerce of South Carolina

Coushatta Tribe of Louisiana

Kialegee Tribal Town

Mississippi Band of Choctaw Indians

Chickasaw Nation

Miccosukee Tribe of Indians of Florida

United Keetoowah Band of Cherokee Indians

The Chaloklowa Chickasaw Indian People

Seminole Tribe of Florida

Absentee-Shawnee Tribe of Oklahoma

Eastern Band of Cherokee Indians

Georgia Tribe of Eastern Cherokee

The American Cherokee Confederacy

Appendix E

Compliance Status and Consultation Correspondence

Appendix E

Southern Nuclear Operating Company's (SNC) Compliance Status and Consultation Correspondence

Correspondence received during the process of evaluation of the application for renewal of the license for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) is identified in Table E-1. Copies of the correspondence are included at the end of this appendix.

The licenses, permits, consultations, and other approvals obtained from Federal, State, regional, and local authorities for VEGP, are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (R. Franovich)	State Historical Preservation Office (R. Luce)	August 22, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	Advisory Council on Historic Preservation (D. Klima)	August 22, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	National Marine Fisheries Service (D. Bernhart)	August 22, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	U.S. Fish and Wildlife Service (S. Colwell)	August 22, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	Pee Dee Tribe of South Carolina (J. Caulder)	August 31, 2007[a]
National Oceanic and Atmospheric Administration (D. Bernhart)	U.S. Nuclear Regulatory Commission (R. Franovich)	September 11, 2007
Miccosukee Tribe (S. Terry)	U.S. Nuclear Regulatory Commission (R. Franovich)	October 3, 2007

[a] Similar letters were sent to 34 other Native American Tribes listed in Appendix C.

Table E-2. Federal, State, Local, and Regional Licenses, Permits, Consultations, and Other Approvals for Vogtle Electric Generating Plant

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	Operating license, SSES	NPF-068	1/16/1987	01/16/2027	Authorizes operation of Unit 1
NRC	10 CFR Part 50	Operating license, SSES	NPF-081	2/9/1989	02/09/2029	Authorizes operation of Unit 2
FWS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	N/A	N/A	N/A	Requires a Federal agency to consult with FWS regarding whether a proposed action will affect endangered or threatened species
NMFS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	N/A	N/A	N/A	
Georgia Dept. of Natural Resources, Historic Preservation Division	Section 106 of the National Historic Preservation Act (16 USC 470f)	Consultation	N/A	N/A	N/A	The National Historic Preservation Act requires Federal agencies to take into account the effect of any undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.
U.S. Dept. of Transportation	49 USC 5108	Registration	051007550004P	6/15/2006	6/30/2008	Hazardous materials shipments
U.S. Army Corps of Engineers	Section 10 of River and Harbor Act of 1899 (33 USC 403)	Permit	200500606	8/24/2005	8/31/2010	Maintenance dredging in front of the river intake structure
Georgia Department of Natural Resources	Clean Water Act (33 USC 1251 et seq.), Georgia Water Quality Control Act, NPDES	Permit	GA0026786	6/30/1999	5/31/2004 administratively extended	Industrial wastewater discharges to Savannah River

Table E-2. (cont'd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
Georgia Department of Natural Resources	Clean Water Act (33 USC 1251 et seq.), Georgia Water Quality Control Act, NPDES	Permit	GAR000000	8/1/2006	7/31/2011	Industrial storm water discharges
Georgia Department of Natural Resources	Clean Water Act (33 USC 1251 et seq.), Georgia Water Quality Control Act, NPDES	Permit	GAR100001	8/13/2003	7/31/2008	Storm water discharges associated with construction activities for standalone construction projects
Georgia Department of Natural Resources	Clean Air Act (42 USC 7401 et seq), Georgia Air Quality Act (OCGA Section 12-9-1) and Georgia Rules for Air Quality Control (Chapter 391-3-1)	Operating Permit	4911-033-0030-V-02-0	3/21/2006	3/21/2011	Installation of temporary boiler package in chemical cleaning of steam generators
			4911-033-0030-V-02-1	9/26/2006	3/21/2011	
Georgia Department of Natural Resources	Georgia Safe Drinking Water Act of 1977 (OCGA 12-5-170 et seq.) and Rules, Chapter 391-3-5	Permit	PG0330017	3/17/2006	4/14/2016	Operate nontransient noncommunity makeup wells – Plant Vogtle Makeup Wells #1 and #2A
Georgia Department of Natural Resources	Georgia Safe Drinking Water Act of 1977 (OCGA 12-5-170 et seq.) and Rules, Chapter 391-3-5	Permit	NG03300367	4/1/1998	3/31/2008	Operate public transient noncommunity water system – Plant Vogtle Employee Recreation Area
Georgia Department of Natural Resources	Georgia Safe Drinking Water Act of 1977 (OCGA.12-5-170 et seq.) and Rules, Chapter 391-3-5	Permit	PG0330035	4/1/1998	3/31/2008	Operate public non-transient noncommunity water system – Plant Vogtle Simulator Building

Table E-2. (cont'd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
Georgia Department of Natural Resources	Georgia Water Quality Control Act, Rules and Regulations for Water Quality Control, Chapter 391-3-6	Permit	017-0191-05	4/17/2000	9/1/2010	Withdraw surface water from the Savannah River for the purpose of cooling and in-plant use
Georgia Department of Natural Resources	Provisions of the Groundwater Use Act (GA Laws 1972, p 976 et seq. as amended by GA Laws 1973, p 1273 et seq.) and Rules and Regulations	Permit	017-0003	3/24/2000	8/6/2010	Withdraw 6 million gpd groundwater from 8 wells in the Cretaceous Sand Aquifer for sanitary facilities, central water supply, cooling water, process water and irrigation
Georgia Department of Natural Resources	Georgia Solid Waste Management Act, Act 1486, Georgia Laws of 1972, as amended and Rules and Regulations	Permit	017-006D(L)(I) No. 2	7/10/1981	None	Dispose of 1500 cubic yards of asbestos transite board and cement asbestos pipe materials
Georgia Department of Natural Resources	Georgia Solid Waste Management Act, Act 1486, p. 1002 et seq. as amended	Permit	017-007D(L)(I) No. 3	6/15/1987	None	Dispose of nonhazardous, nonputrescible waste
Georgia Department of Natural Resources	Rules for Solid Waste Management, Section 391-3-4-.06(3)(a)	Permit by Rule Operations	PBR-017-07COL	11/13/2000	None	Collect and transport nonhazardous, nonindustrial, putrescible waste for disposal in permitted MSWLF
State of Georgia Public Service Commission	Transportation of Hazardous Materials Act, Act 394 at OCGA 46:11	Notification of shipment of hazardous materials – permit by rule	DOT Hazardous Materials Certification 051007 550 004P	5/11/2007	6/30/2008	Transportation of radioactive materials in the state of Georgia

Table E-2. (cont'd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
South Carolina Department of Health and Environmental Control – Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	South Carolina Radioactive Waste Transport Permit	0311-10-08-X	12/14/2006	12/31/2008	Transportation of radioactive waste into the state of South Carolina
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation Rule 1200-2-10.32	Tennessee Radioactive Waste License-for-Delivery	T-GA003-L08	01/01/2007	12/31/2008	Transportation of radioactive waste into the state of Tennessee

August 22, 2007

Dr. Ray Luce
Historical Preservation Division
Georgia Department of Natural Resources
34 Peachtree St., Suite 1600
Atlanta, GA 30303-2316

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Dr. Luce:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing a license renewal application (LRA) submitted by Southern Nuclear Operating Company (SNC or the applicant) dated June 27, 2007 for the renewal of the operating licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP), pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). VEGP is located approximately 15 miles east-northeast of Waynesboro, Georgia and 26 miles southeast of Augusta, Georgia.

The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal, may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On September 27, 2007, the NRC will conduct two public NEPA scoping meetings at the Augusta Technical College Waynesboro Campus, 216 Highway 24 South, Waynesboro, GA. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend. The staff expects to publish the draft SEIS in May 2008. Your office will receive a copy of the draft SEIS along with a request for comments.

R. Luce -2-

If you have any questions, regarding the NRC staff review of this LRA, please contact Mr. J.P. Leous, the Environmental Project Manager, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

cc: See next page

R. Luce -2-

If you have any questions, regarding the NRC staff review of this LRA, please contact Mr. J.P. Leous, the Environmental Project Manager, at 301-415-2864 or by e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

cc: See next page

DISTRIBUTION:
P.T. Kuo (RidsNrrDlr)
R. Franovich (RidsNrrDlrRebb)
E. Benner (RidsNrrDlrReba)
J. Davis
L. Lund
J. Leous
C. Jacobs
Bobbie.hurley@earthtech.com
D. Ashley
B. Singal
B. Anderson
G. McCoy
S. Shaeffer
RidsOGCMailRoom
DLR/REBB
DLR/REBA

ADAMS Accession No.: **ML072060519**

OFFICE	LA:DLR	PM:DLR:REBB	PM:DLR:REBB	BC:DLR:REBB
NAME	IKing	JPLeous	AWilliamson	RFranovich (w/edits)
DATE	7/31/07	8/13/07	8/13/07	8/22/07

OFFICIAL RECORD COPY

Vogtle Electric Generating Plant Units 1 and 2

cc:

Mr. Tom E. Tynan
Vice President - Vogtle
Vogtle Electric Generating Plant
7821 River Road
Waynesboro, GA 30830

Mr. N. J. Stringfellow
Manager, Licensing
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Jeffrey T. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Steven M. Jackson
Senior Engineer - Power Supply
Municipal Electric Authority of Georgia
1470 Riveredge Parkway, NW
Atlanta, GA 30328-4684

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, SW
Atlanta, GA 30334

Mr. Harold Reheis, Director
Department of Natural Resources
205 Butler Street, SE, Suite 1252
Atlanta, GA 30334

Attorney General
Law Department
132 Judicial Building
Atlanta, GA 30334

Mr. Laurence Bergen
Oglethorpe Power Corporation
2100 East Exchange Place
P.O. Box 1349
Tucker, GA 30085-1349

Arthur H. Domby, Esquire
Troutman Sanders
Nations Bank Plaza
600 Peachtree Street, NE
Suite 5200
Atlanta, GA 30308-2216

Resident Inspector
Vogtle Plant
8805 River Road
Waynesboro, GA 30830

Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Ms. Julie Keys
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708

August 22, 2007

Mr. Don L. Klima, Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave, NW, Suite 803
Washington, DC 20004

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP), which is located approximately 15 miles east-northeast of Waynesboro, Georgia and 26 miles southeast of Augusta, Georgia. VEGP is operated by Southern Nuclear Operating Company, Inc. (SNC). The application for renewal was submitted by SNC on June 29, 2007, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

The NRC staff plans to hold two public NEPA scoping meetings on September 27, 2007, at the Augusta Technical College Waynesboro Campus, 216 Highway 24 South, Waynesboro, GA. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. In addition, during the week of October 15, 2007, the NRC staff plans to conduct a site audit at VEGP. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is May 2008.

D. Klima -2-

If you have any questions or require additional information, please contact the Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

cc: See next page

D. Klima -2-

If you have any questions or require additional information, please contact the Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

cc: See next page

DISTRIBUTION:
P.T. Kuo (RidsNrrDlr)
R. Franovich (RidsNrrDlrRebb)
E. Benner (RidsNrrDlrReba)
J. Davis
C. Jacobs
J. Leous
Bobbie.hurley@earthtech.com
D. Ashley
B. Singal
B. Anderson
G. McCoy
S. Shaeffer
R. Hannah
RidsOGCMailRoom
DLR/REBB
DLR/REBA

Adams Accession No. ML072060568

OFFICE	LA:DLR	PM:DLR:REBB	PM:DLR:REBB	BC:DLR:REBB
NAME	IKing	JPLeous	AWilliamson	RFranovich (w/edits)
DATE	7/31/07	8/1/07	8/13/07	8/22/07

OFFICIAL RECORD COPY

Vogtle Electric Generating Units 1 & 2

cc:

Mr. Tom E. Tynan
Vice President - Vogtle
Vogtle Electric Generating Plant
7821 River Road
Waynesboro, GA 30830

Mr. N. J. Stringfellow
Manager, Licensing
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Jeffrey T. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Steven M. Jackson
Senior Engineer - Power Supply
Municipal Electric Authority of Georgia
1470 Riveredge Parkway, NW
Atlanta, GA 30328-4684

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, SW
Atlanta, GA 30334

Mr. Harold Reheis, Director
Department of Natural Resources
205 Butler Street, SE, Suite 1252
Atlanta, GA 30334

Attorney General
Law Department
132 Judicial Building
Atlanta, GA 30334

Mr. Laurence Bergen
Oglethorpe Power Corporation
2100 East Exchange Place
P.O. Box 1349
Tucker, GA 30085-1349

Arthur H. Domby, Esquire
Troutman Sanders
Nations Bank Plaza
600 Peachtree Street, NE
Suite 5200
Atlanta, GA 30308-2216

Resident Inspector
Vogtle Plant
8805 River Road
Waynesboro, GA 30830

Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Ms. Julie Keys
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708

August 22, 2007

Mr. David Bernhart
Assistant Regional Administrator
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701

SUBJECT: REQUEST FOR A LIST OF PROTECTED SPECIES AND ESSENTIAL FISH HABITAT WITHIN THE AREA UNDER EVALUATION FOR THE VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Bernhart:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Southern Nuclear Operating Company, Inc., for the renewal of the operating licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP). VEGP is located on the southwest side of the Savannah River in eastern Burke County Georgia. It is approximately 15 miles east-northeast of Waynesboro, Georgia, and 26 miles southeast of Augusta, Georgia. As part of the review of the license renewal application, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to marine resources and habitat. This letter is being submitted under the provisions of the Endangered Species Act of 1973; as amended, the Fish and Wildlife Coordination Act of 1934; as amended; and the Sustainable Fisheries Act of 1996.

The proposed action is to renew the facility operating licenses for VEGP for an additional 20 years beyond the expiration of the current operating license. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The VEGP industrial facility covers approximately 3,169-acres. Enclosures 1 and 2 provide a general overview of the site location and site layout.

VEGP is equipped with two cooling towers that withdraw makeup water from and discharge it to the Savannah River. The river water intake system includes the intake canal, a four-bay intake structure, four intake pumps, condensers, two natural draft cooling towers, and an underground single port discharge pipe into the Savannah River.

Approximately 360 miles of corridor that occupy approximately 7,200 acres are within the scope of review for this action. The Environmental Report lists six transmission lines that Southern Nuclear Operating Company, Inc., built to connect VEGP to the transmission system (Enclosure 3):

- Scherer – This 500-kV line runs generally westward to Plant Scherer, north of Macon, Georgia. Built in 1986, it is 154 miles long and in a corridor that is mostly 150 feet wide, but up to 400 feet wide in some locations.

D. Bernhart -2-

- West McIntosh (Thalmann) – Running 69 miles to the south, this 500-kV line, in a 150-feet wide corridor, connects VEGP to the West McIntosh substation near Plant McIntosh, just north of Savannah, Georgia. It then continues for 90 miles to its termination at the Thalmann substation near Brunswick.

- Goshen (Black) and Goshen (White) – The two 230-kV Goshen lines connect to the Goshen substation approximately 19 corridor miles from VEGP. The corridor is 275 feet wide and the lines were built in 1986. These two lines, plus 17 miles of the Augusta Newsprint line, share the corridor.

- Augusta Newsprint – The Augusta Newsprint substation is approximately 20 corridor miles from VEGP. The corridor is 275 feet wide until the 230-kV Augusta Newsprint line diverges from the Goshen lines at 17 miles and is 100 to 125 feet wide for the remaining distance.

- SCE&G – Built in 1986, this 230-kV line runs north and east for 4.5 miles to cross the Savannah River and then an additional 17 miles to a substation operated by SCE&G. The corridor in South Carolina is 100 feet wide and the Georgia segment is 125 feet wide.

- Wilson – This 1.4-mile long transmission line is wholly contained on Georgia Power Company property. It connects VEGP to Plant Wilson at 230-kV. The corridor is 150 feet wide. Enclosure 3 shows the transmission system of interest.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of VEGP and its associated transmission line right-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act. Also, in support of the SEIS preparation and to ensure compliance with Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act, the NRC requests a list of essential fish habitat that has been designated in the vicinity of the VEGP site and its associated transmission line corridors.

The NRC staff plans to hold two public NEPA scoping meetings on September 27, 2007, at the August Technical College Waynesboro Campus, 216 Highway 24 South, Waynesboro, GA. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. In addition, during the week of October 15, 2007, the NRC staff plans to conduct a site audit at VEGP. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is May 2008.

D. Bernhart -3-

If you have any questions regarding the NRC staff review of this license renewal application, please contact the NRC Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

Enclosures:
1. 50 mile radius
2. Site layout
3. Transmission line map

cc w/encls: See next page

D. Bernhart -3-

If you have any questions regarding the NRC staff review of this license renewal application, please contact the NRC Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

Enclosures:
1. 50 mile radius
2. Site layout
3. Transmission line map

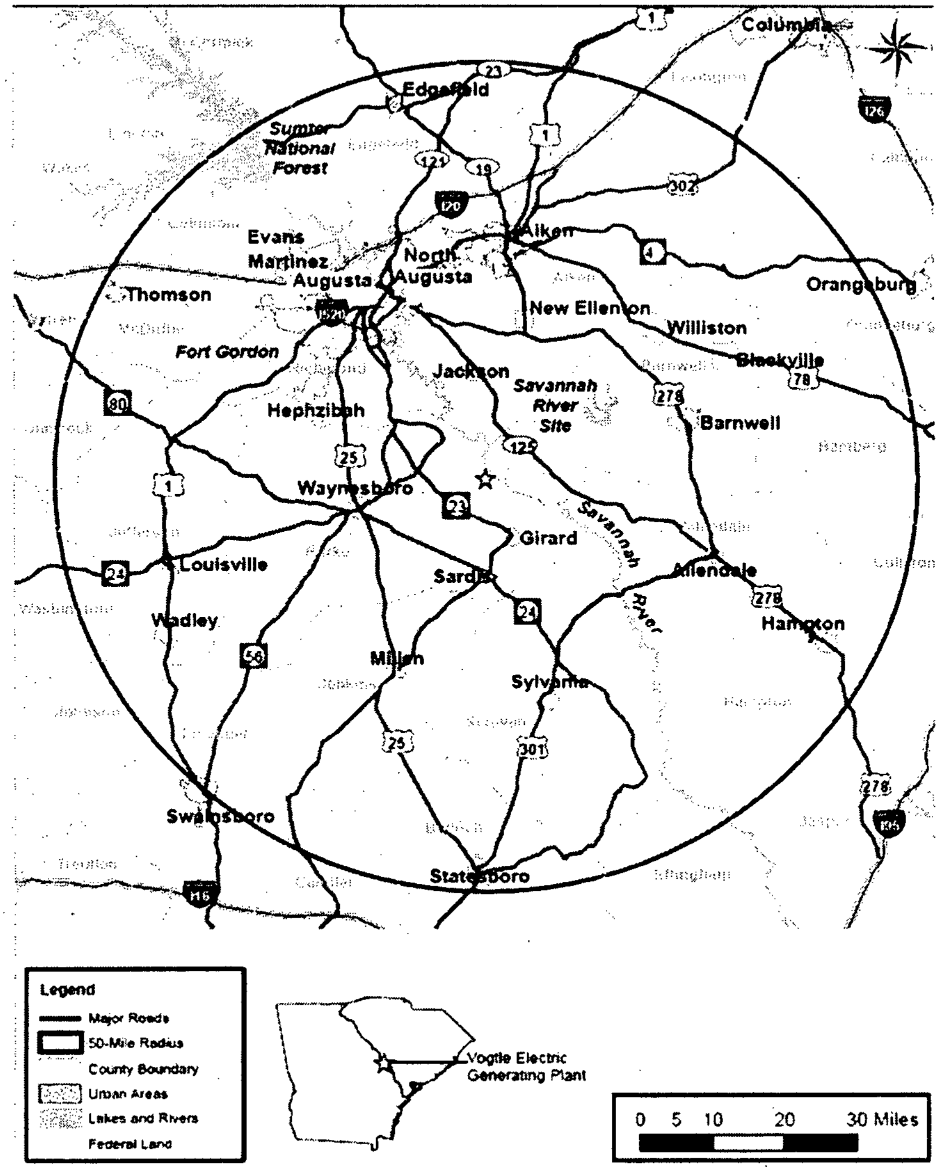
cc w/encls: See next page

DISTRIBUTION:
P.T. Kuo (RidsNrrDlr)
R. Franovich (RidsNrrDlrRebb)
E. Benner (RidsNrrDlrReba)
L. Lund
J. Leous
C. Jacobs
L. Wexler
N. Goodman
Bobbie.hurley@earthtech.com
D. Ashley
B. Singal
B. Anderson
G. McCoy
S. Shaeffer
R. Hannah
RidsOGCMailRoom
DLR/REBB
DLR/REBA

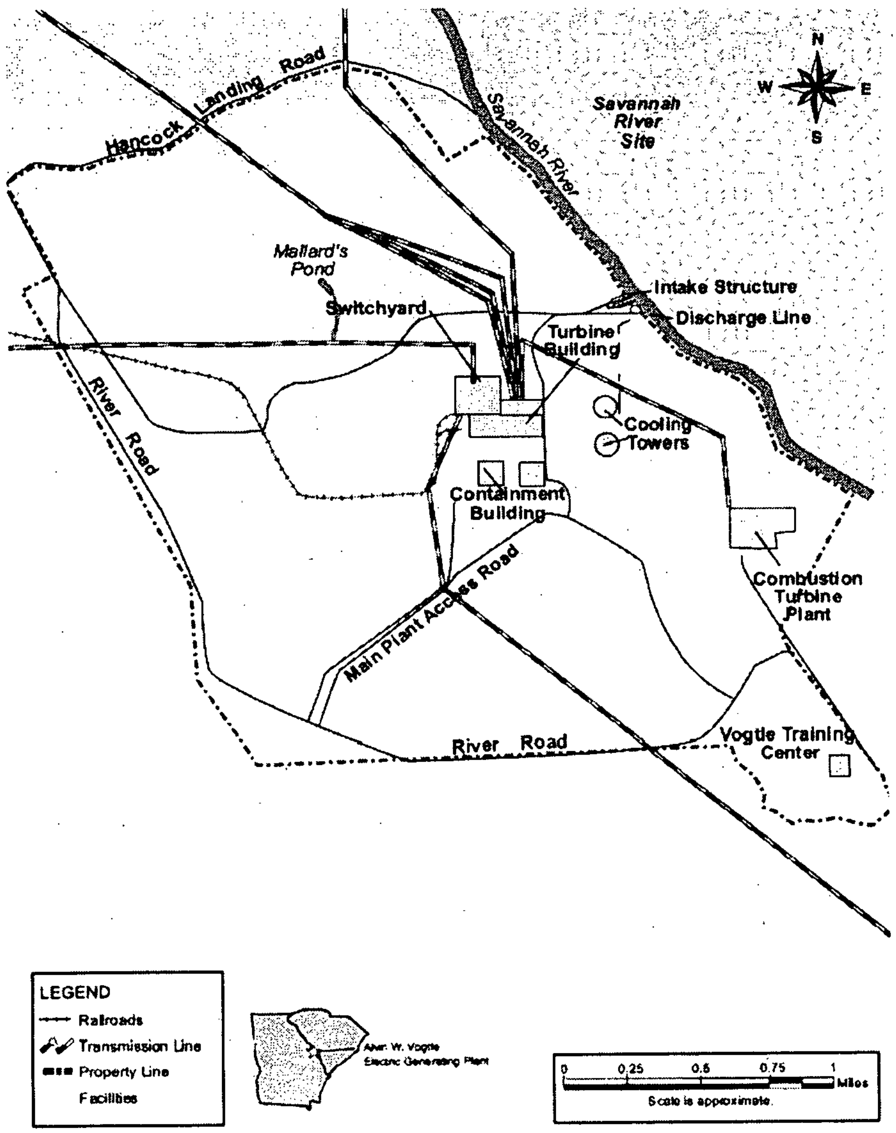
ADAMS Accession No.: **ML072060605**

OFFICE	LA:DLR	PM:DLR:REBB	PM:DLR:REBB	BC:DLR:REBB
NAME	IKing	JPLeous	AWilliamson	Rfranovich (w/edits)
DATE	07/31/07	08/13/07	08/14/07	08/22/07

OFFICIAL RECORD COPY

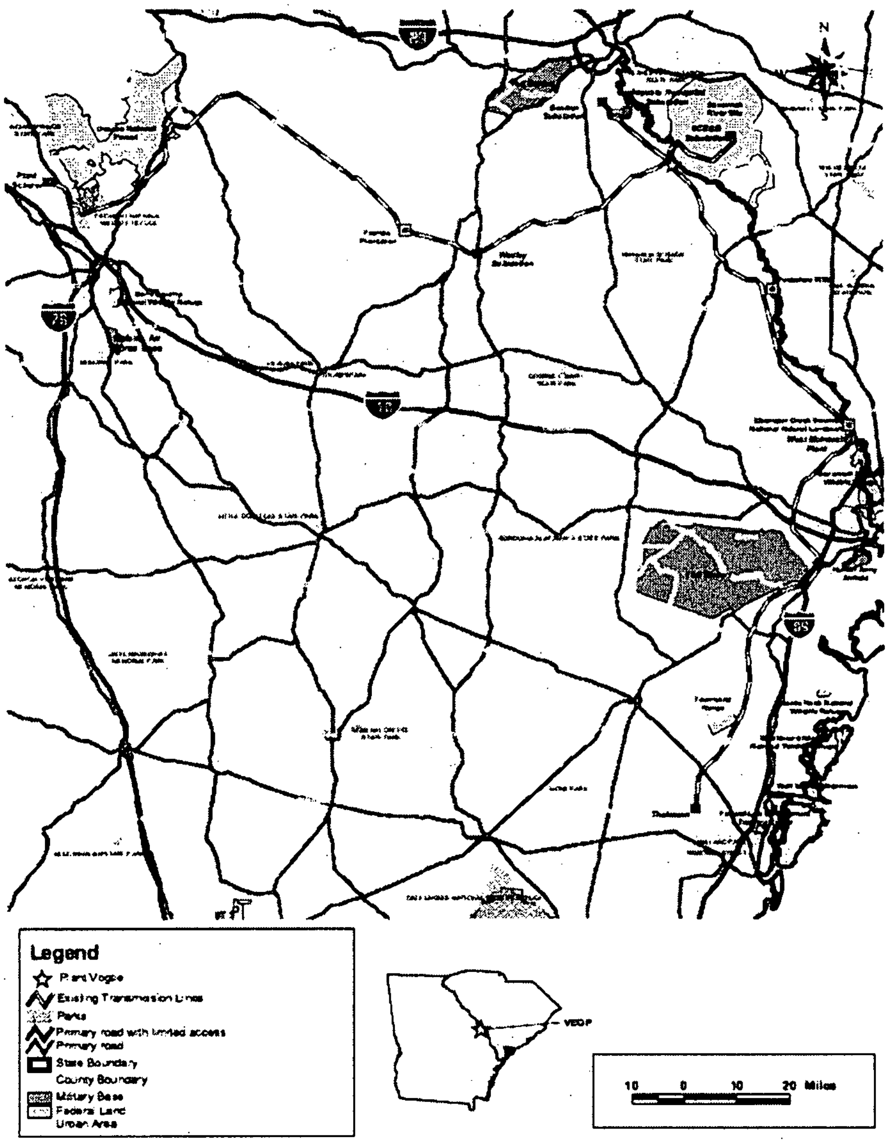

Columbia
Edgefield
Sumter National Forest
Evans
Martinez
Augusta
North Augusta
Aiken
Thomson
Fort Gordon
New Ellenton
Williston
Orangeburg
Blackville
Jackson
Savannah River Site
Barnwell
Hephzibah
Waynesboro
Girard
Savannah River
Louisville
Sardis
Allendale
Wadley
Hampton
Millen
Sylvania
Swainsboro
Statesboro
Legend
Major Roads
50-Mile Radius
County Boundary
Urban Areas
Lakes and Rivers
Federal Land
Vogtle Electric Generating Plant
0 5 10 20 30 Miles

Enclosure 1



Hancock Landing Road
Savannah River
Savannah River Site
N
W
E
S
Mallard's Pond
Switchyard
Intake Structure
Discharge Line
Turbine Building
Cooling Towers
River Road
Containment Building
Main Plant Access Road
Combustion Turbine Plant
Vogtle Training Center
River Road
LEGEND
Railroads
Transmission Line
Property Line
Facilities
0
0.25
0.5
0.75
1
Miles
Scale is approximate.

Enclosure 2


Legend
Plant Vogtle
Existing Transmission Lines
Parks
Primary road with limited access
Primary road
State Boundary
County Boundary
Military Base
Federal Land
Urban Area
VEGP
10 0 10 20 Miles

Enclosure 3

Vogtle Electric Generating Plant Units 1 and 2

cc:

Mr. Tom E. Tynan
Vice President - Vogtle
Vogtle Electric Generating Plant
7821 River Road
Waynesboro, GA 30830

Mr. N. J. Stringfellow
Manager, Licensing
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Jeffrey T. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Steven M. Jackson
Senior Engineer - Power Supply
Municipal Electric Authority of Georgia
1470 Riveredge Parkway, NW
Atlanta, GA 30328-4684

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, SW
Atlanta, GA 30334

Mr. Harold Reheis, Director
Department of Natural Resources
205 Butler Street, SE, Suite 1252
Atlanta, GA 30334

Attorney General
Law Department
132 Judicial Building
Atlanta, GA 30334

Mr. Laurence Bergen
Oglethorpe Power Corporation
2100 East Exchange Place
P.O. Box 1349
Tucker, GA 30085-1349

Arthur H. Domby, Esquire
Troutman Sanders
Nations Bank Plaza
600 Peachtree Street, NE
Suite 5200
Atlanta, GA 30308-2216

Resident Inspector
Vogtle Plant
8805 River Road
Waynesboro, GA 30830

Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Ms. Julie Keys
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708

August 22, 2007

Mr. Strant Colwell, Supervisor
U.S. Fish and Wildlife Service
4270 Norwich St.
Brunswick, GA 31520

SUBJECT: REQUEST FOR A LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Colwell:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application submitted by Southern Nuclear Operating Company, Inc., for the renewal of the operating licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP). VEGP is located on the southwest side of the Savannah River in eastern Burke County Georgia. It is approximately 15 miles east-northeast of Waynesboro, Georgia, and 26 miles southeast of Augusta, Georgia. As part of the review of the license renewal application, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action is to renew the operating licenses for VEGP for an additional 20 years beyond the expiration of the current operating licenses. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The VEGP industrial facility covers approximately 3,169-acres. Enclosures 1 and 2 provide a general overview of the site location and site layout.

VEGP is equipped with two cooling towers that withdraw makeup water from and discharge it to the Savannah River. The river water intake system includes the intake canal, a four-bay intake structure, four intake pumps, condensers, two natural draft cooling towers, and an underground single port discharge pipe into the Savannah River.

Approximately 360 miles of corridor that occupy approximately 7,200 acres are within the scope of review for this action. The Environmental Report lists six transmission lines that Southern Nuclear Operating Company, Inc., built to connect VEGP to the transmission system (Enclosure 3):

- Scherer – This 500-kV line runs generally westward to Plant Scherer, north of Macon, Georgia. Built in 1986, it is 154 miles long and in a corridor that is mostly 150 feet wide, but up to 400 feet wide in some locations.

S. Colwell -2-

- West McIntosh (Thalmann) – Running 69 miles to the south, this 500-kV line, in a 150-feet wide corridor, connects VEGP to the West McIntosh substation near Plant McIntosh, just north of Savannah, Georgia. It then continues for 90 miles to its termination at the Thalmann substation near Brunswick.

- Goshen (Black) and Goshen (White) – The two 230-kV Goshen lines connect to the Goshen substation approximately 19 corridor miles from VEGP. The corridor is 275 feet wide and the lines were built in 1986. These two lines, plus 17 miles of the Augusta Newsprint line, share the corridor.

- Augusta Newsprint – The Augusta Newsprint substation is approximately 20 corridor miles from VEGP. The corridor is 275 feet wide until the 230-kV Augusta Newsprint line diverges from the Goshen lines at 17 miles and is 100 to 125 feet wide for the remaining distance.

- SCE&G – Built in 1986, this 230-kV line runs north and east for 4.5 miles to cross the Savannah River and then an additional 17 miles to a substation operated by SCE&G. The corridor in South Carolina is 100 feet wide and the Georgia segment is 125 feet wide.

- Wilson – This 1.4-mile long transmission line is wholly contained on Georgia Power Company property. It connects VEGP to Plant Wilson at 230-kV. The corridor is 150 feet wide. Enclosure 3 shows the transmission system of interest.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of VEGP and its associated transmission line right-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

The NRC staff plans to hold two public NEPA scoping meetings on September 27, 2007, at the Augusta Technical College Waynesboro Campus, 216 Highway 24 South, Waynesboro, GA. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. In addition, during the week of October 15, 2007, the NRC staff plans to conduct a site audit at VEGP. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is May 2008.

S. Colwell -3-

If you have any questions regarding the NRC staff review of this license renewal application, please contact the NRC Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424, 50-425

Enclosures:
1. 50 mile radius
2. Site layout
3. Transmission Map

cc w/encls: See next page

S. Colwell -3-

If you have any questions regarding the NRC staff review of this license renewal application, please contact the NRC Environmental Project Manager, Mr. J.P. Leous, at 301-415-2864 or via e-mail at jpl1@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424, 50-425

Enclosures:
1. 50 mile radius
2. Site layout
3. Transmission Map

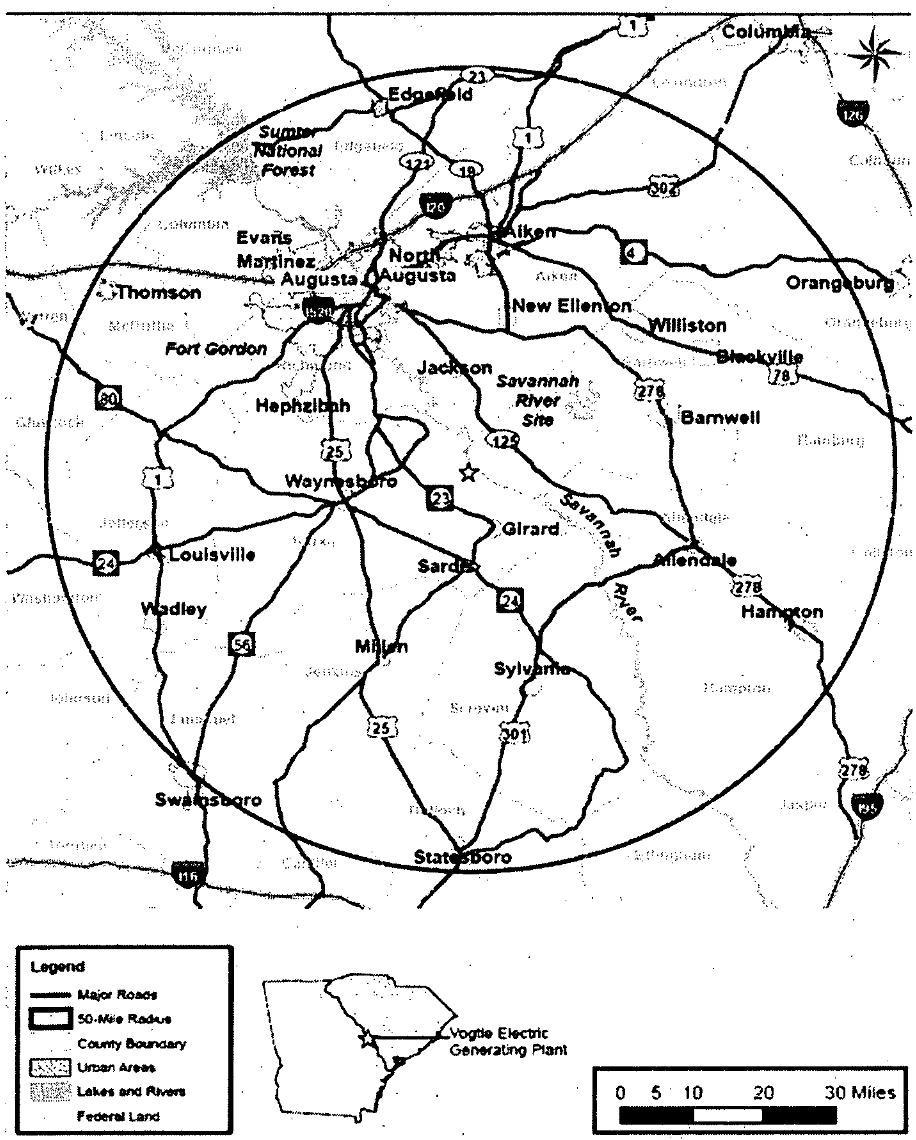
cc w/encls: See next page

DISTRIBUTION:
P.T. Kuo (RidsNrrDlr)
R. Franovich (RidsNrrDlrRebb)
E. Benner (RidsNrrDlrReba)
J. Leous
C. Jacobs
Bobbie.hurley@earthtech.com
B. Ashley
R. Hannah
B. Singal
B. Anderson
G. McCoy
S. Shaeffer
RidsOGCMailRoom
DLR/REBB
DLR/REBA

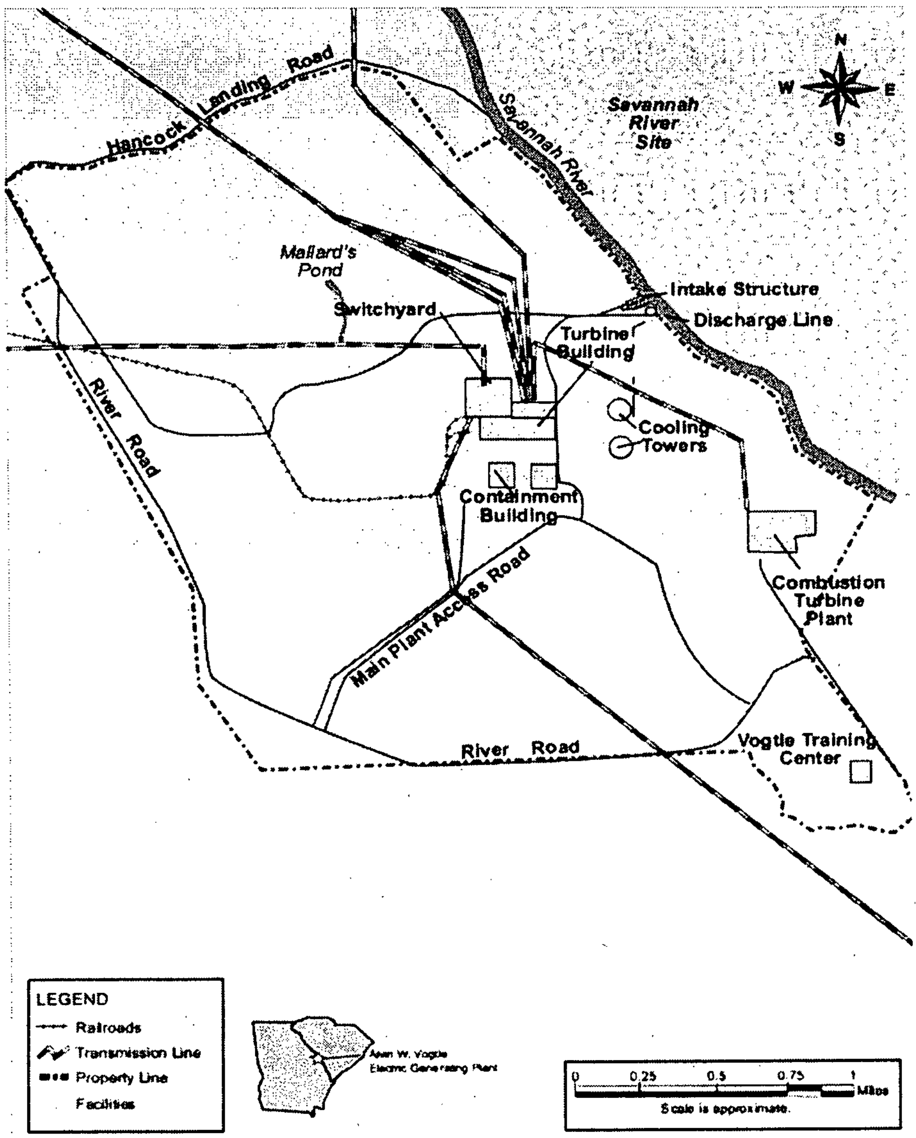
Adam Accession No.: **ML072040219**

OFFICE	LA:DLR	PM:DLR:REBB	PM: DLR:REBB	BC:DLR:REBB
NAME	IKing	JPLeous	AWilliamson	RFranovich (w/edits)
DATE	7/31/07	8/13/07	8/14/07	8/22/07

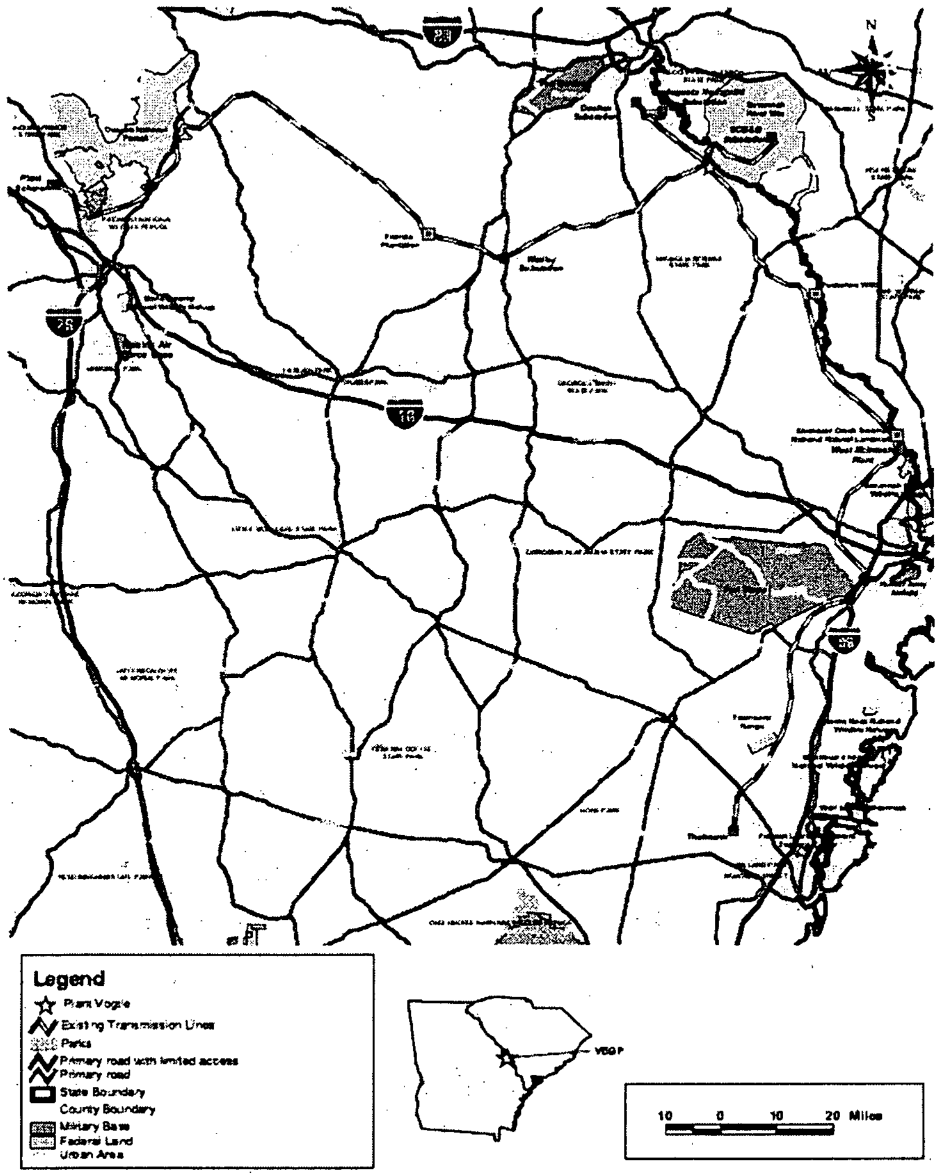
OFFICIAL RECORD COPY


Columbia
Edgefield
Sumter National Forest
Evans
Martinez
Augusta
North Augusta
Aiken
Thomson
Fort Gordon
New Ellenton
Williston
Orangeburg
Blackville
Barnwell
Jackson
Savannah River Site
Hephzibah
Waynesboro
Girard
Savannah River
Louisville
Sardis
Allendale
Wadley
Hampton
Millen
Sylvania
Swainsboro
Statesboro
Legend
Major Roads
50-Mile Radius
County Boundary
Urban Areas
Lakes and Rivers
Federal Land
Vogtle Electric Generating Plant
0 5 10 20 30 Miles

Enclosure 1


Hancock Landing Road
Savannah River
Savannah River Site
N
W
E
S
Mallard's Pond
Switchyard
Intake Structure
Discharge Line
Turbine Building
Cooling Towers
Containment Building
River Road
Main Plant Access Road
Combustion Turbine Plant
River Road
Vogtle Training Center
LEGEND
Railroads
Transmission Line
Property Line
Facilities
0 0.25 0.5 0.75 1 Miles
Scale is approximate.

Enclosure 2


Legend
Plant Vogtle
Existing Transmission Lines
Parks
Primary road with limited access
Primary road
State Boundary
County Boundary
Military Base
Federal Land
Urban Area
VEGP
10 0 10 20 Miles

Enclosure 3

Vogtle Electric Generating Plant, Units 1 and 2

cc:

Mr. Tom E. Tynan
Vice President - Vogtle
Vogtle Electric Generating Plant
7821 River Road
Waynesboro, GA 30830

Mr. N. J. Stringfellow
Manager, Licensing
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Jeffrey T. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Steven M. Jackson
Senior Engineer - Power Supply
Municipal Electric Authority of Georgia
1470 Riveredge Parkway, NW
Atlanta, GA 30328-4684

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, SW
Atlanta, GA 30334

Mr. Harold Reheis, Director
Department of Natural Resources
205 Butler Street, SE, Suite 1252
Atlanta, GA 30334

Attorney General
Law Department
132 Judicial Building
Atlanta, GA 30334

Mr. Laurence Bergen
Oglethorpe Power Corporation
2100 East Exchange Place
P.O. Box 1349
Tucker, GA 30085-1349

Arthur H. Domby, Esquire
Troutman Sanders
Nations Bank Plaza
600 Peachtree Street, NE
Suite 5200
Atlanta, GA 30308-2216

Resident Inspector
Vogtle Plant
8805 River Road
Waynesboro, GA 30830

Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Ms. Julie Keys
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708

August 31, 2007

Ms. Carolyn Chavis Bolton, Chief
The Pee Dee Indian Nation of Upper
South Carolina
3814 Highway 57 N.
Little Rock, SC 29576

SUBJECT: REQUEST FOR COMMENTS CONCERNING THE VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Chief Bolton:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of an application from Southern Nuclear Operating Company (SNC or the applicant) for the renewal of the operating licenses for the Vogtle Electric Generating Plant, Units 1 and 2 (VEGP), located in Waynesboro, Burke County, Georgia. VEGP is in close proximity to lands that may be of interest to the Pee Dee Indian Nation of Upper South Carolina. As described below, the NRC's process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, Section 51.28(b), the NRC invites the Pee Dee Indian Nation of Upper South Carolina to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8(c), the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating licenses for VEGP will expire in 2027 and 2029. SNC submitted its application for renewal of the VEGP operating licenses in a letter dated June 27, 2007.

The NRC is gathering information for a VEGP site-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the VEGP site related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action. Provided for your information is the VEGP Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2).

C. Bolton -2-

To accommodate interested members of the public, the NRC will hold two public scoping meetings for the VEGP license renewal supplement to the GEIS on September 27, 2007, at the Augusta Technical College Waynesboro Campus, located at 216 Highway 24 South, Waynesboro, GA. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session.

The license renewal application (LRA) and the GEIS are publicly available at the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://adamswebsearch.nrc.gov/dologin.htm. The Accession Number for the LRA is ML071840360, and ML071840357 for the environmental report. Persons who do not have access to ADAMS, or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's PDR Reference staff by telephone at 1-800-397-4209 or 301-415-4737, or by e-mail at pdr@nrc.gov.

The VEGP LRA is also available on the Internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/vogtle.html. In addition, the Burke County Library, located at 130 Highway 24 South, Waynesboro, GA, has agreed to make the LRA available for public inspection.

The GEIS, which documents the NRC's assessment of the scope and impact of environmental effects that would be associated with license renewal at any nuclear power plant site, can also be found at the Burke County Library, on the NRC's website, and at the NRC's PDR.

Please submit any comments that the Pee Dee Indian Nation of Upper South Carolina may have to offer on the scope of the environmental review by October 24, 2007. Written comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Electronic comments may be submitted to the NRC by e-mail at Vogtle_LR_EIS@nrc.gov. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and mail a copy to you.

C. Bolton -3-

The staff expects to publish the draft supplement to the GEIS in May 2008. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft supplemental environmental impact statement (SEIS). A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for VEGP is planned for January 2009. If you need additional information regarding the environmental review process, please contact JP Leous, Environmental Project Manager, at 301-415-2864 or at jpl1@nrc.gov.

Sincerely,

/RA Jennifer Davis for/

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

Enclosures:
1. Site Layout
2. Transmission Line Map

cc w/encls: See next page

C. Bolton -3-

The staff expects to publish the draft supplement to the GEIS in May 2008. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft supplemental environmental impact statement (SEIS). A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for VEGP is planned for January 2009. If you need additional information regarding the environmental review process, please contact JP Leous, Environmental Project Manager, at 301-415-2864 or at jpl1@nrc.gov.

Sincerely,

/RA Jennifer Davis for/

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

Enclosures:
1. Site Layout
2. Transmission Line Map

cc w/encls: See next page

DISTRIBUTION: See next page

ADAMS Accession No. ML072210375

OFFICE	LA:DLR	PM:DLR:REBB	PM:DLR:REBB	BC:DLR:REBB
NAME	SFigueroa	JPLeous	SHernandez	JDavis for RFranovich
DATE	08/10/07	08/31/07	08/31/07	08/31/07

OFFICIAL RECORD COPY

Letter to C. Bolton from R. Franovich, dated August 31, 2007

SUBJECT: REQUEST FOR COMMENTS CONCERNING THE VOGTLE ELECTRIC GENERATING PLANT UNITS 1 AND 2 LICENSE RENEWAL APPLICATION REVIEW

DISTRIBUTION:
E-mail
P.T. Kuo (RidsNrrDlr)
R. Franovich (RidsNrrDlrRebb)
E. Benner (RidsNrrDlrReba)
Bobbie.hurley@earthtech.com
J.P. Leous
C. Jacobs
D. Ashley
B. Singal
B. Anderson
G. McCoy
S. Shaeffer
R. Bores
R. Trajanowski
V. Lickus
W. Maier
R. Hannah
J. Schlueter
R. Trojanowski
RidsOpaMail

Vogtle Electric Generating Plant, Units 1 and 2

cc:

Mr. Tom E. Tynan
Vice President - Vogtle
Vogtle Electric Generating Plant
7821 River Road
Waynesboro, GA 30830

Mr. N. J. Stringfellow
Manager, Licensing
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Jeffrey T. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. Steven M. Jackson
Senior Engineer - Power Supply
Municipal Electric Authority of Georgia
1470 Riveredge Parkway, NW
Atlanta, GA 30328-4684

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, SW
Atlanta, GA 30334

Mr. Harold Reheis, Director
Department of Natural Resources
205 Butler Street, SE, Suite 1252
Atlanta, GA 30334

Attorney General
Law Department
132 Judicial Building
Atlanta, GA 30334

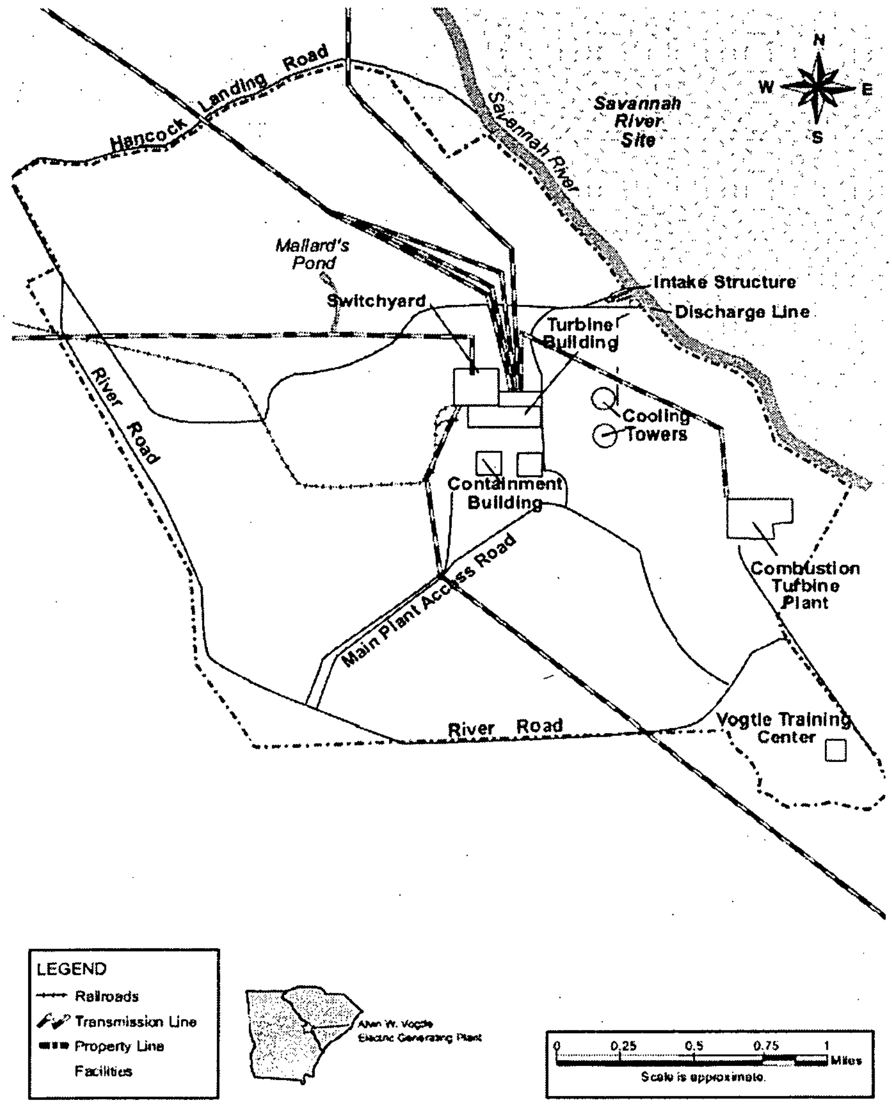
Mr. Laurence Bergen
Oglethorpe Power Corporation
2100 East Exchange Place
P.O. Box 1349
Tucker, GA 30085-1349

Arthur H. Domby, Esquire
Troutman Sanders
Nations Bank Plaza
600 Peachtree Street, NE
Suite 5200
Atlanta, GA 30308-2216

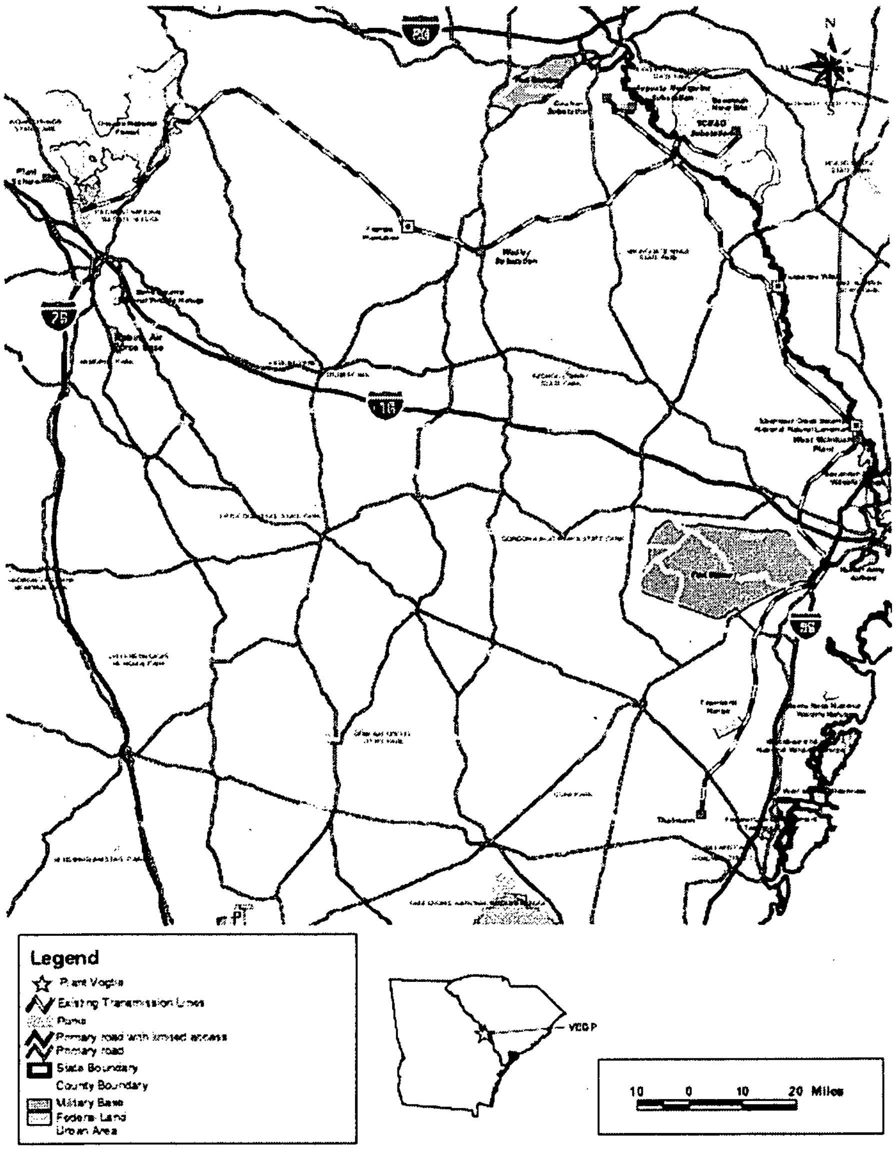
Resident Inspector
Vogtle Plant
8805 River Road
Waynesboro, GA 30830

Office of the County Commissioner
Burke County Commission
Waynesboro, GA 30830

Ms. Julie Keys
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708


Hancock Landing Road
Savannah River
Savannah River Site
N
W
E
S
Mallard's Pond
Switchyard
Intake Structure
Discharge Line
Turbine Building
Cooling Towers
Containment Building
River Road
Main Plant Access Road
Combustion Turbine Plant
Vogtle Training Center
River Road
LEGEND
Railroads
Transmission Line
Property Line
Facilities
Alvin W. Vogtle Electric Generating Plant
0 0.25 0.5 0.75 1 Miles
Scale is approximate.

Enclosure 1


N
S
20
25
16
95
Legend
Plant Vogtle
Existing Transmission Lines
Parks
Primary road with limited access
Primary road
State Boundary
County Boundary
Military Base
Federal Land
Urban Area
VEGP
10 0 10 20 Miles

Enclosure 2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Ave. South
St. Petersburg, FL 33701
(727) 824-5312, FAX (727) 824-5309
http://sero.nmfs.noaa.gov

SEP 11 2007

F/SER3:TM

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Mr. Franovich:

This correspondence responds to the Nuclear Regulatory Commission's (NRC) letter dated August 22, 2007, regarding the renewal of operating licenses for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) in Burke County, Georgia.

As requested, enclosed is a list of federally-protected species under the jurisdiction of the National Marine Fisheries Service for the state of Georgia.

We look forward to continued cooperation with the NRC in conserving our endangered and threatened resources. If you have any questions regarding the ESA consultation process, please contact Mr. Robert Hoffman, fishery biologist, at (727) 824-5312, or by e-mail at Robert.Hoffman@noaa.gov.

Sincerely,

David M. Bernhart
Assistant Regional Administrator
Protected Resources Division

Enclosure

File: 1514-22.M NRC

Endangered and Threatened Species and Critical Habitats
under the Jurisdiction of the NOAA Fisheries Service

Georgia

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaengliae*	Endangered	12/02/70
right whale	*Eubalaena glacialis*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78
Fish			
shortnose sturgeon	*Acipenser brevirostrum*	Endangered	03/11/67
smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/03

Designated Critical Habitat
Right whale: Between 31°15'N (approximately the mouth of the Altamaha River, Georgia) and 30°15'N (approximately Jacksonville, Florida) from ~~the~~ coast out to 15 nautical miles offshore; the coastal waters between 30°15'N and 28°00'N (approximately Sebastian Inlet, Florida) from the coast out to 5 nautical miles.

Species Proposed for Listing
None

Proposed Critical Habitat
None

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered

Georgia

Candidate Species[2]	Scientific Name
None	

Species of Concern[3]	Scientific Name
Fish	
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
dusky shark	*Carcharhinus obscurus*
night shark	*Carcharinus signatus*
sand tiger shark	*Carcharias taurus*
speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*
white marlin	*Tetrapturus albidus*

[2] The Candidate Species List has been renamed the Species of Concern List. The term "candidate species" is limited to species that are the subject of a petition to list and for which NOAA Fisheries Service has determined that listing may be warranted (69 FR 19975).

[3] Species of Concern are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
REGIONAL OFFICE
263 13th AVENUE SOUTH
ST. PETERSBURG, FL 33701

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

AN EQUAL OPPORTUNITY EMPLOYER

US OFFICIAL MAIL
$300 Penalty
For Private Use
$00.41⁰
09/12/2007
Mailed From 33701
US POSTAGE
Hasler

IIF1

[redacted]

20555+0001

VOGTLE_LR_EIS - The Miccosukee Tribal Elders have decided that the Tribe will limit itself to those matters within t Page 1

From: "Steve Terry" <SteveT@miccosukeetribe.com>
To: <VOgtle_LR_EIS@nrc.gov>
Date: Wed, Oct 3, 2007 12:17 PM
Subject: The Miccosukee Tribal Elders have decided that the Tribe will limit itself to those matters within t

The Miccosukee Tribal Elders have decided that the Tribe will limit itself to those matters within the State of Florida. Therefore, the Tribe will defer to the wishes of the other Tribes which have a more direct cultural affiliation with this site.

Thank you for consulting with the Miccosukee Tribe. Please call me at 305.223.8380, Ext. 2243, if you require additional information.

Steve Terry
NAGPRA & Section 106 Representative
Miccosukee Tribe
P.O. Box 440021
Miami, FL 33144-0021
(305) 223-8380, Ext. 2243
(305) 223-8380, Ext. 2243
Stevet@miccosukeetribe.com

Return-path:	<SteveT@miccosukeetribe.com>
Received:	from mail2.nrc.gov [148.184.176.43] by NRNWMS02.NRC.GOV; Wed, 03 Oct 2007 12:16:49 -0400
X-Ironport-ID:	mail2
X-SBRS:	None
X-MID:	10929291
X-IronPort-Anti-Spam-Filtered:	true
X-IronPort-Anti-Spam-Result:	Ao8CAAJdA0dB1E8D/2dsb2JhbAA
X-IronPort-AV:	E=Sophos;i="4.21,225,1188792000"; d="scan'208";a="10929291"
Received:	from mail.miccosukeetribe.com (HELO mit_ms2.miccosukeetribe.com) ([65.212.79.3]) by mail2.nrc.gov with ESMTP; 03 Oct 2007 12:16:49 -0400
Received:	from MIT-DOMAIN-MTA by mit_ms2.miccosukeetribe.comwith Novell_GroupWise; Wed, 03 Oct 2007 12:16:41 -0400
Message-Id:	<s7038829.033@mit_ms2.miccosukeetribe.com>
X-Mailer:	Novell GroupWise Internet Agent 6.5.4
Received:	Wed, 03 Oct 2007 12:16:06 -0400
From:	"Steve Terry" <SteveT@miccosukeetribe.com>
To:	<VOgtle_LR_EIS@nrc.gov>
Subject:	The Miccosukee Tribal Elders have decided that the Tribe willlimit itself to those matters within t
Mime-Version:	1.0
Content-Type:	text/plain; charset=US-ASCII
Content-Transfer-Encoding:	quoted-printable
Content-Disposition:	inline

The Miccosukee Tribal Elders have decided that the Tribe will limit itself =
to those matters within the State of Florida. Therefore, the Tribe will =
defer to the wishes of the other Tribes which have a more direct cultural =
affiliation with this site.

Thank you for consulting with the Miccosukee Tribe. Please call me at =
305.223.8380, Ext. 2243, if you require additional information.

Steve Terry
NAGPRA & Section 106 Representative
Miccosukee Tribe
P.O. Box 440021
Miami, FL 33144-0021
(305) 223-8380, Ext. 2243
(305) 223-8380, Ext. 2243
Stevet@miccosukeetribe.com

Biological Assessment

Vogtle Electric Generating Plant Units 1 and 2
License Renewal

April 2008

Docket Numbers 50-424 and 50-425

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Biological Assessment of the Potential Effects on Federally Listed Endangered or Threatened Species from the Proposed License Renewal for the Vogtle Electric Generating Plant

1.0 Introduction and Purpose

The U.S. Nuclear Regulatory Commission (NRC) issues operating licenses for domestic nuclear power plants in accordance with the provisions of the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. The NRC is reviewing an application submitted by Southern Nuclear Operating Company, Inc. (SNC) for the renewal of operating licenses NPF-68 and NPF-81 for Vogtle Electric Generating Plant Units 1 and 2 (VEGP) for 20 years beyond the current operating license expiration dates of January 16, 2027 for Unit 1 and February 9, 2029 for Unit 2 (NRC's Agency-wide Documents Access and Management System [ADAMS] accession no. ML071840360). The purpose and need for this proposed action is to provide an option that permits electric power generation to continue beyond the term of the current nuclear power plant operating license, allowing future electric generating needs to be met, if the operator and State regulatory agencies pursue that option.

The SNC, which operates VEGP, prepared an Environmental Report (SNC 2007a; ADAMS accession no. ML071840357) as part of its application for the renewal of the VEGP operating licenses. In the Environmental Report, SNC analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects. The NRC is using the Environmental Report and additional information as the basis for this Biological Assessment (BA) and a Supplemental Environmental Impact Statement (SEIS), a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437* (NRC 1996), referred to hereafter as the GEIS.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, NRC staff requested in a letter dated August 22, 2007 (NRC 2007a) that the National Marine Fisheries Service (NMFS) provide information on Federally listed endangered or threatened species, as well as proposed or candidate species, and any designated critical habitats that may occur in the vicinity of VEGP. In its response, the NMFS provided a list of Federally protected species under its jurisdiction for the State of Georgia (NMFS 2007).

Although the NRC staff does not believe that license renewal would adversely affect the Federally listed species under NMFS jurisdiction, the Staff has prepared this BA to document its review. This BA examines the potential effects of the continued operation of VEGP on the Federally endangered and threatened species under NMFS jurisdiction that potentially could occur in the vicinity of the VEGP site and its associated transmission line right-of-ways (ROWs).

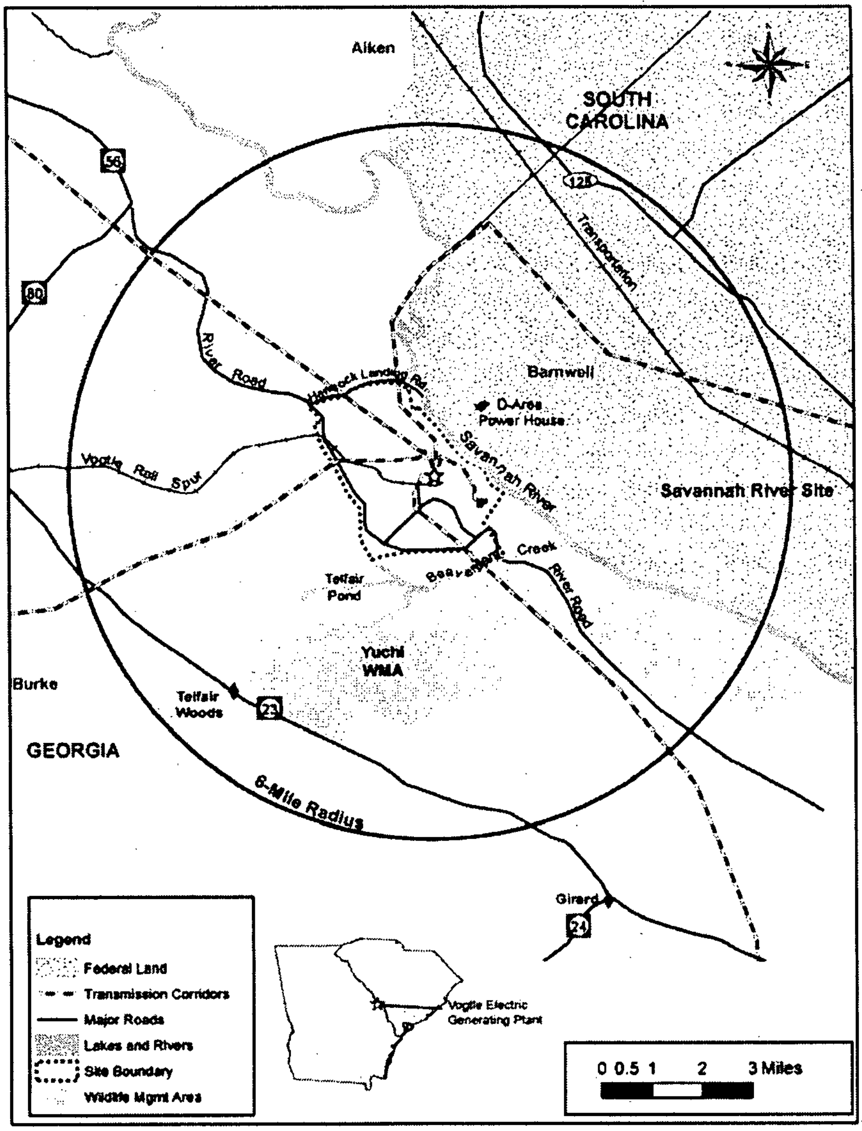
2.0 Site Description

The proposed Federal action is renewal of the operating license for VEGP. The VEGP facility is located in Burke County, Georgia, approximately 15 miles (mi) east-northeast of Waynesboro, Georgia and 26 mi southeast of Augusta, Georgia. The location of the facility and the areas within 6 mi of the facility are shown in Figure 2-1 (SNC 2007a). The Savannah River borders the VEGP site on the north and east. The VEGP site, covering 3169 acres (ac), is located between river mile (RM) 150 and 152 (river kilometer [rkm] 241 and 244). Terrestrial resources found within the VEGP site and associated transmission line ROWs include upland, riparian, and bottomland forest communities, as well as ponds, streams, and wetlands. Fauna consists mainly of wildlife species commonly found in eastern Georgia, including mammals, birds, reptiles, and amphibians.

Located directly across the river from VEGP is the Savannah River Site (SRS), a Federally owned Department of Energy (DOE) facility that covers a total area of 310 square mi. Although SRS is not specifically associated with the proposed relicensing of VEGP and is not owned or maintained by SNC, its close proximity, the types of operations historically conducted at SRS, and the numerous ecological studies that have been conducted in conjunction with SRS have made it particularly relevant to the evaluation of VEGP impacts on the Savannah River. Five nuclear reactors and two processing facilities for the production of nuclear weapons materials were built on SRS, with construction completed in 1955. The SRS reactors utilized once-through cooling systems that withdrew water from the Savannah River, and the heated water was discharged to tributaries of the river (Reed et al. 2002). All SRS nuclear reactors were shut down by 1989, though other nuclear-related operations, research and development, environmental remediation, and ecological studies are ongoing at the facility (Reed et al. 2002).

The VEGP site is within the reach referred to as the middle Savannah River, a segment extending from the Fall Line (a line along which waterfalls occur at the transition from the Piedmont to the Coastal Plain) just above Kiokee Creek in Columbia County, Georgia at RM 221 south to the mouth of Brier Creek at RM 97 in Screven County, Georgia (Figure 3-2). The Savannah River watershed is approximately 10,579 square mi (USACE 1996). From the Hartwell Dam, the Savannah River flows 289 mi to the Atlantic Ocean at Savannah, Georgia. The U. S. Army Corps of Engineers (USACE) operates three dams that are located upstream from the VEGP site: the Hartwell Dam (RM 288.9); the Richard B. Russell Dam (RM 259.1); and the J. Strom Thurmond Dam (RM 221.6). Between the J. Strom Thurmond Dam and the VEGP site lie the Stevens Creek Dam (RM 208.1), the city of Augusta (approximately RM 200), the New Savannah Bluffs Lock and Dam (RM 187.7), and the mouths of several small creeks (SNC 2006a).

The Savannah River adjacent to the VEGP site is relatively straight with very few bends. The substrate in the deep areas is mostly gravel with some sand (SNC 2006a). Between 1973 and 1996, the average water temperature was 17.4°C (63.40°F), with a maximum of 27.2°C (81.0°F)



Source: SNC 2007a

Figure 2-1. Location of VEGP, 6-mile Radius and a minimum of 5.0°C (41.0°F) (SNC 2006a). The middle Savannah River is habitat for many types of aquatic organisms, and, typical of southeastern river basins, the growing human population increasingly affects the area. Habitats used by fish in the Savannah include the main river channel, "cutoff bends" or "dead rivers" (former channels still connected to the main channel), and streams or smaller tributaries that empty into the river. Additional habitat is provided by swamps and floodplains during high water (Marcy et al. 2005).

2.1 Description of Plant and Cooling and Auxiliary Water Systems

VEGP consists of two Westinghouse pressurized water reactors (PWRs) with a reactor core power of 3,565 megawatts-thermal (MW[t]) and an approximate net electrical output of 1,232 megawatts-electrical (MW[e]) for each unit (SNC 2007a). The circulating water system at VEGP uses two natural draft cooling towers as part of a closed-cycle heat dissipation system, which withdraws water from the Savannah River and discharges blowdown back to the River (SNC 2007a). The intake system consists of a 365-ft-long intake canal located on the western bank of the Savannah River (SNC 2007a). The earthen bottom of the river at the intake is 67 ft above mean sea level (msl). A skimmer weir is located at the canal entrance, with a bottom elevation of 78 ft above msl, and a canal weir is located within the canal 100 ft from the entrance. The skimmer weir prevents floating materials from entering the intake canal (SNC 2007a). The intake structure at the head of the canal contains four bays (two for each unit), each with a stop log, trash rack, traveling screens, and a single pump (SNC 2007a). The trash racks consist of a series of vertical flat bars, and the traveling screens are annealed type 304 stainless steel 3/8-inch mesh (SNC 2007a). As the system operates, wash water is used to rinse the traveling screens and drive debris into a debris basket, which is emptied periodically (SNC 2007a). Daily inspections are performed, and according to facility personnel, fish or other aquatic organisms are rarely observed (SNC 2007a).

The circulating water is removed from the intake by vertical turbine pumps, each with a capacity of 22,000 gallons per minute (gpm) (SNC 2007a). The circulating water is directed into the natural draft cooling towers, which use natural convection to remove heat from water that has been used to cool the condensers (SNC 2007a). Because the cooling towers operate as a closed system, the only water loss is through evaporation, drift, and blowdown. Makeup water is withdrawn from the river to replace these losses. The cooling water is treated with several chemicals to control biofouling, corrosion, and scaling (SNC 2007a). The cooling tower blowdown and other liquid wastestreams (such as the liquid radioactive waste treatment effluents) are discharged back to the Savannah River through a discharge structure located 500 ft downstream of the intake structure.

3.0 Status Review of Shortnose Sturgeon

The only Federally listed aquatic species that is under the jurisdiction of NMFS and is recorded as occurring in the vicinity of the VEGP site is the shortnose sturgeon (*Acipenser brevirostrum*), which is endangered. The shortnose sturgeon occurs in the Savannah River both upstream and downstream of VEGP but has no designated critical habitat in the vicinity of the VEGP site (NMFS 1998, NRC 2007b). The shortnose sturgeon also occurs in the Altamaha and Ogeechee Rivers, which are crossed by the West McIntosh (Thalmann) transmission line in the Coastal Plain. Because no changes in operations, expansion of existing facilities, or disturbance of additional land associated with the transmission lines are expected during the license renewal period, the shortnose sturgeon populations in the Altamaha and Ogeechee Rivers would not be adversely affected by the transmission line crossings of these rivers. Accordingly, those populations are not discussed further.

3.1 Life History

The shortnose sturgeon is a member of the family Acipenseridae, a group of anadromous and freshwater fishes with long life spans and an ancient lineage. The shortnose sturgeon spawns in large Atlantic coastal rivers in eastern North America from northern Florida to New Brunswick, Canada. The shortnose sturgeon grows slowly, reaches sexual maturity relatively late in life, and typically lives 15-20 years (a reported record longevity was 67 years). It reaches maturity at a body length (nose to tail fork) of 18 to 20 inches (45 to 50 centimeters [cm]) and has a maximum total length of approximately 4 feet (ft) (1.2 meter [m]) and weight of up to 50 pounds (lbs) (23 kilograms [kg]). It is the smallest of the three sturgeon species that occur in eastern North America. The shortnose sturgeon was a commercially important species around the beginning of the 20th century, and it was also frequently taken with the catch of Atlantic sturgeon, a closely related and more commercially valuable sturgeon species, and as bycatch in the shad fishery. The substantial decline in shortnose sturgeon populations has been attributed mainly to overfishing, the impoundment of rivers, and water pollution. Natural recruitment rates appear to be too low to fully replenish depleted populations (NMFS 1998, NOAA 2007, Marcy et al. 2005).

The shortnose sturgeon originally was listed as an endangered species by the FWS under the Endangered Species Preservation Act (32 FR 4001) in 1967. That act preceded the Endangered Species Act (ESA) of 1973 (16 USC 1531), under which the sturgeon is protected currently. In 1974, the shortnose sturgeon was placed under the jurisdiction of NMFS, the agency responsible for most anadromous and marine species under the ESA. Although the shortnose sturgeon was originally listed as endangered throughout its range, the NMFS currently recognizes 19 distinct population segments occurring in 19 river systems from northern Florida to New Brunswick, Canada. Life history studies indicate that populations from these river systems largely are reproductively isolated and should be considered separate. NMFS considers that the loss of a single shortnose sturgeon population segment may risk the permanent loss of unique genetic information potentially critical to the survival and recovery of the species. Therefore, the species is managed based on protection of the distinct population segments in each of these river systems, including the Savannah River (NMFS 1998).

Shortnose sturgeon spend most of their lives in their natal river systems and enter the ocean only rarely. In the southern part of its range, this species is estuarine anadromous. Thus, adult shortnose sturgeon in the Savannah River forage in the river estuary throughout the year except when migrating upstream during spawning runs. Spawning runs typically occur in the Savannah River from late January to March, and most of the spawning adults return to the lower portion of the river by early May. Probable spawning sites in the Savannah River were identified by studying the movements of adult shortnose sturgeon. The studies identified reaches that repeatedly were the destinations of migrating adult fish and were occupied for several days during the spawning season (Meyer et al. 2003). The probable spawning sites identified consist of sharp curves of the river channel with substrates of rocks, logs, gravel, and sand in two principal reaches: from RM 111 to 118 (rkm 179 to 190) and from RM 170 to 172 (rkm 275 to 278) (NMFS 1998, Meyer et al. 2003). The VEGP site is located on the Savannah River between RM 150 and 152 (rkm 241 to 244), a reach that is between the two identified spawning reaches and has not been identified as a known or suspected spawning site.

Shortnose sturgeon reach sexual maturity at about 8 to 15 years of age in the north and at younger ages in the south (Marcy et al. 2005). Sexually mature adults usually spawn during peak flood tide in February or March in or near deep areas of the river where there is a significant current. Spawning usually occurs when water temperatures are between 50°F (9.8°C) and 62°F (16.5°C). Data indicate that adults spawn at intervals of 2 to 5 years. The fertilized eggs of the shortnose sturgeon are heavier than water (demersal), so they tend to sink quickly, and they are extremely adhesive, so they adhere to solid substrates such as rocks and logs. The eggs hatch in 1 to 2 weeks. The larvae and the early juveniles into which they develop are weak swimmers that stay near the bottom. After about 2 weeks of drifting with the current near the bottom, they slowly migrate downstream (Marcy et al. 2005). When the juveniles reach the estuary at the lower end of the Savannah River, they tend to remain in the reach between RM 29 and 19 (rkm 48 and 31) near the saltwater-freshwater interface. They move into the upstream area of this estuary in summer and the downstream area in winter (Meyer et al. 2003). The diet of juvenile shortnose sturgeon is mainly aquatic insects and small crustaceans. Adults feed mainly on molluscs and also consume crustaceans and insects (Marcy et al. 2005).

3.2 Status of Shortnose Sturgeon in the Savannah River

As part of a state and Federal recovery program, over 97,000 hatchery-spawned shortnose sturgeon (18 percent of which were tagged) were stocked in the Savannah River between 1984 and 1992 (Marcy et al. 2005). Over 35 percent of the juvenile shortnose sturgeon that were captured in the Savannah River from 1990 to 1993 were identified as having been stocked (Wike 1998). Based on records of marked fish and results from tagging studies, it was estimated that approximately 38 percent of the adult population in the Savannah River during the period 1997 to 2000 consisted of stocked fish (Marcy et al. 2005). These results indicate that recruitment into the local population was occurring (Wike 1998). The most recent estimate of the shortnose sturgeon population of the Savannah River, from 1999, was 3000 fish (NMFS 2006).

3.3 Potential Site-Related Impacts on the Shortnose Sturgeon

The VEGP facility withdraws water from the Savannah River for use as makeup water for the cooling tower system. The Savannah River population of the shortnose sturgeon potentially could be affected by VEGP operations due to several factors associated with these cooling water withdrawals as well as related discharges to the river. These factors include the following: (1) reduction in the flow within the Savannah River due to makeup water withdrawals, (2) increase in shortnose sturgeon mortality due to entrainment and/or impingement at the VEGP intake, (3) thermal effects from the VEGP discharge, and (4) toxic effects from VEGP-related chemical constituents in surface water of the river. Each of these factors is addressed below.

3.3.1 Water Withdrawal Effects

The Georgia Department of Natural Resources (GDNR) permits VEGP to withdraw water from the Savannah River at a monthly average rate of up to 131 cubic feet per second (cfs) (85 mgd) (GDNR 2007). According to the Environmental Report, the actual capacity of the intake system is 89 cfs (SNC 2007a), of which an estimated 66.8 cfs is lost through evaporation, blowdown, and drift (NRC 1985), resulting in a net consumptive use of water from the river (SNC 2007a). The actual surface water withdrawal reports provide a different estimate. The highest monthly average for water withdrawal in 2006, the most recent complete year for which data were available, was 103.8 cfs in May (SNC 2007b). Based on this highest monthly average withdrawal rate in 2006 and a 75 percent water consumption ratio provided in the Environmental Report (SNC 2007a), the highest average consumptive use of river water by the facility in 2006 was calculated to be 77.9 cfs.

In its Drought Contingency Plan for the Savannah River basin, the USACE established operational rules for the reservoirs using lake levels as triggers to reduce discharges to specified levels. At J. Strom Thurmond Dam, Drought Level 1 reduces flow released at the dam to a maximum weekly average of 4200 cfs, Level 2 reduces flow to a maximum weekly average of 4000 cfs, Level 3 reduces flow to a maximum daily average of 3800 cfs, and Level 4 requires that daily average outflow equal daily average inflow to the reservoir (USACE 2008). Drought Level 3 maintains sufficient flow for water users downstream. Only if the water level in the reservoir drops below the bottom of the conservation pool (312 feet above msl) under Level 4 does the plan require that water be released at the same rate as it flows into the reservoir (USACE 2007). In 2006, GEPD established instream flow guidelines for the regulation of surface water withdrawals based on the 7Q10 flow, which is the lowest average flow over seven consecutive days expected to occur with an average frequency of once in ten years (UGA Carl Vinson Institute of Government 2006). The instream flow guidelines are the basis of the minimum flow of 3800 cfs for the Savannah River under Drought Level 3 (SNC 2007c). Although there have been days on which the Savannah River flow was less then 3800 cfs, such low flows have been rare, and the water level in the reservoir has not been as low as 312 feet above msl since 1956 (USGS 2007a).

Thus, the lowest expected flow in the Savannah River is the instream flow guideline of 3800 cfs (USACE 2007) under Drought Level 3. Although the state of Georgia currently is considered to be in a period of severe drought and Level 3 has been triggered (USGS 2007b), the flow at the Waynesboro measuring station at VEGP has not dropped below 3900 cfs since measurements began at that location in early 2005 (USGS 2007c). Based on the values discussed above for the highest consumptive use of Savannah River water by the operation of VEGP Units 1 and 2 in 2006 (77.9 cfs) and the lowest expected river flow (3800 cfs), the highest expected consumptive use would be approximately 2 percent of the flow.

During an extreme drought in which river flow is below the Drought Level 4 action level, an estimated minimum flow that may occur in the Savannah River based on historical data is 957 cfs (SNC 2006b). This minimum flow was estimated through a statistical analysis of flow conditions in the river from 1926 through 1950, before the reservoirs were constructed upstream. Under this minimum flow of only 957 cfs, consumptive use by Units 1 and 2 would be approximately 8 percent of the flow. In a worst-case scenario, the VEGP facility potentially could continue to operate at river flows as low as 500 cfs. Although the facility is not legally required to stop withdrawals at such low flows, the low water level of the river would physically prevent withdrawals by VEGP (SNC 2006b). At this very low river flow, water use by VEGP would consume approximately 15 percent of the Savannah River flow.

Therefore, at expected river flows under severe drought conditions (3800 cfs), the reduction in flow due to the normal withdrawal and consumptive use of river water by VEGP Units 1 and 2 would be less than 2 percent. Under much more extreme conditions of drought and low flow, withdrawals could result in higher percentage reductions in river flow but no more than 15 percent. However, such conditions have not occurred since the construction of the upstream reservoirs and would have an extremely low likelihood of occurring in the future.

The consumptive use of less than 2 percent of flows even under severe drought conditions at normal withdrawal rates indicates that there is minimal potential for adverse effects on the shortnose sturgeon from the effects of water withdrawals by VEGP Units 1 and 2. The greatest reasonably foreseeable reduction in river flow due to the operation of VEGP Units 1 and 2 during the renewal term even under severe drought conditions would be sufficiently minor that it would not adversely affect the shortnose sturgeon, its prey, or other components of the aquatic community. Accordingly, the Staff finds that water withdrawals by the VEGP CWIS are not likely to adversely affect the shortnose sturgeon population of the Savannah River.

3.3.2 Entrainment/Impingement Effects

The intake of cooling water from the Savannah River and the associated potential for eggs or larvae to be entrained in the cooling water system or for larger individuals to be impinged on the intake screens are the principal concerns regarding potential impacts on the shortnose sturgeon from VEGP operations. Entrainment occurs when organisms are drawn through the intake screens into the cooling water system. Organisms that typically become entrained are relatively small planktonic or nektonic organisms in the water column, such as the early life stages of fish (66 FR 65256). As entrained organisms pass through a facility's cooling system, they are subjected to mechanical, thermal, and toxic stresses that often are fatal. Impingement occurs when larger organisms are trapped against the intake screens by the force of the water passing through the screens (66 FR 65256). Impingement can result in starvation and exhaustion, asphyxiation from the force of the water preventing proper gill movement or from the organisms being removed from the water for prolonged periods of time, and the loss of scales (66 FR 65256). The relatively small volumes of water needed for a closed-cycle, recirculating, wet cooling tower system such as that use by VEGP Units 1 and 2 result in lower entrainment and impingement effects compared to once-through cooling systems (NRC 1996). In addition to the type of cooling system used by the facility, factors that can influence the degree to which entrainment and impingement affect the shortnose sturgeon and other aquatic biota include the design of the intake structure, the amount of water withdrawn (NRC 2007b), and the biology of the organisms.

In promulgating regulations to reduce entrainment impacts from existing cooling water intake structures at power plants under section 316(b) of the Clean Water Act (EPA 2004), EPA did not require entrainment reductions for facilities that withdraw 5 percent or less of the annual mean flow from freshwater rivers. EPA determined that such facilities generally have a low likelihood of causing significant entrainment impacts because their intake withdrawals are a low proportion of flow (EPA 2004). Based on an annual mean Savannah River flow at Augusta, Georgia, of 9157 cfs (SNC 2007a) and the highest monthly average withdrawal rate of 103.8 cfs (in May 2006), the withdrawal by VEGP Units 1 and 2 would be 1.1 percent of the annual mean flow. Based on a flow of 3800 cfs under severe drought conditions and the same conservative withdrawal rate, the withdrawal by VEGP Units 1 and 2 would be 2.7 percent of flow. Thus, even under severe drought conditions, the VEGP withdrawal would be only half of the level EPA selected to minimize entrainment impacts.

The potential for entrainment of the shortnose sturgeon also is affected by its life history and behavior. As described in Section 3.1, adult shortnose sturgeon in the Savannah River forage in the river estuary throughout the year except during spawning runs, when they migrate upstream from late January to March. Spawning usually takes place in or adjacent to deep areas of the river with significant currents in February or March, and most adults return to the lower river by early May. In the Savannah River, probable spawning sites were identified in two principal reaches where there are sharp curves of the channel and substrates of logs, rocks, gravel, and sand: from RM 111 to 118 (rkm 179 to 190) and from RM 170 to 172 (rkm 275 to 278) (NMFS 1998, Meyer et al. 2003). The VEGP site is between RM 150 and 152 (rkm 241 to 244); thus, it is between the two identified spawning reaches. The upstream spawning reach is approximately 18 RM (29 rkm) above the site, and the downstream reach is approximately 32 RM (52 rkm) below the site.

The only shortnose sturgeon eggs or larvae that potentially could be subject to entrainment at the VEGP intake are those from the upstream spawning location. Entrainment of eggs or larvae from the upstream spawning location into the cooling water system is not expected to occur due to the characteristics of these organisms, the characteristics of the river, and the structure of the intake. Fertilized eggs of the shortnose sturgeon are heavier than water and extremely adhesive, so they sink quickly and adhere to hard substrates such as rocks and logs in the spawning area (Marcy et al. 2005). As a result, fertilized eggs would not occur in the water column in the area of the VEGP intake and would not be entrained. After the eggs hatch, the yolk-sac larvae are weak swimmers and seek cover at the bottom for up to 12 days. During this time, they develop into larvae of about 15 millimeters (mm) total length, with well-developed eyes, teeth, and fins that make them capable of swimming effectively. By the time they reach 20 mm in length, the larvae begin to feed and swim in the water column. It is at this stage that they are likely to begin downstream migration to the estuary (NMFS 1998). When shortnose sturgeon larvae have been collected in rivers, the larvae are generally found in the deepest water near the bottom and usually within the channel (Dadswell et al. 1984, NMFS 1998). The location of the VEGP intake structure near the shoreline in conjunction with this behavioral tendency of the larvae to remain in the deepest part of the channel should minimize the potential for larvae to be entrained as they pass the intake on their downstream migration.

Entrainment studies have not been conducted for VEGP Units 1 and 2 during their operation. Prior to their operation, the NRC estimated the potential for entrainment at these units in the Final Environmental Statement for Operation (NRC 1985). That evaluation assumed a uniform distribution of drift organisms in the Savannah River. Water withdrawals for the Circulating Water Intake Structure (CWIS) were designed to range from approximately 1 to 4 percent of the Savannah River's discharge, depending on CWIS operations and the variation in river discharge. Assuming a uniform distribution of drift organisms and 100 percent mortality of those entrained, NRC concluded that removal of 1 to 3.5 percent of drift organisms from the river would not have a significant adverse effect on the drift organisms or the aquatic community, including fish, in the vicinity of VEGP Units 1 and 2 (NRC 1985).

This estimate of the rate of entrainment is expected to be conservative and considerably higher than the rate likely to actually occur, particularly for the shortnose sturgeon. As discussed above, eggs of the shortnose sturgeon sink and adhere to the substrate at the upstream spawning area, and larval stages migrating downstream past the site tend to remain near the bottom of the river channel (Dadswell et al. 1984, Marcy et al. 2005, NMFS 1998). The upstream spawning reach begins approximately 18 RM upstream of VEGP, and there are no historic records of shortnose sturgeon eggs being collected near the SRS (Wike 1998); therefore, it is very unlikely that shortnose sturgeon eggs would be entrained.

Entrainment studies have been performed for reactor facilities at SRS. Between 1982 and 1985, ichthyoplankton studies were performed between RM 29.3 and 187.1 in the Savannah River as well as in the intake canals for SRS reactors and at the mouths of three creeks along the SRS that received cooling water discharges (Paller et al. 1986 in NRC 2007a). The studies estimated that between 8.3 percent and 12.3 percent of the ichthyoplankton that drifted past the SRS intake canals were entrained. However, the differences between the SRS intakes and the VEGP intakes are substantial. First, the volume of water withdrawn by SRS for the K-Reactor and L-Reactor at full power was 395 cfs (11.2 cubic meters per second [m^3/sec]) for each reactor (Paller 1992 in NRC 2007a), which is more than seven times the highest monthly average withdrawal rate for VEGP Units 1 and 2 (103.8 cfs). Second, the SRS intake canals were much longer than that at VEGP. Third, the intake velocity at the SRS intakes was calculated to be 1.25 feet per second (ft/sec) (38 centimeters per second [cm/sec]) (McFarlane et al. 1978 in NRC 2007a), which is approximately 1.8 times the through-screen velocity of 0.7 ft/sec at the VEGP Units 1 and 2 intake (SNC 2007a).

To evaluate the potential impacts on the shortnose sturgeon from the re-start and operation of the L-Reactor at SRS, which would utilize withdrawals much larger than those of VEGP Units 1 and 2, a BA was performed in 1983 (Muska and Matthews 1983). The BA concluded that entrainment of shortnose sturgeon eggs was unlikely due to their demersal and adhesive characteristics. The BA noted that larval entrainment was possible because four larvae had been collected in or near the intake canals during sampling in the river. However, it concluded that larval entrainment would be minimal because of the low density of larvae found in the intake canals during an extensive ichthyoplankton sampling effort in the vicinity and the preference of the larvae for benthic habitats within the river (Muska and Matthews 1983). The Protected Species Management Branch of the U.S. Department of Commerce concurred with this conclusion (Wike 1998). Based on these lines of evidence, shortnose sturgeon larvae are considered to have very limited susceptibility to being entrained by the VEGP intake.

Impingement studies also have not been performed at the VEGP Unit 1 and 2 intake structure during operations. However, Section 4.1 (entitled Unusual or Important Environmental Events) of the VEGP Units 1 and 2 Environmental Protection Plan, Appendix B to VEGP Units 1 and 2 operating licenses NPF 68 and NPF 81, requires NRC notification of any unusual environmental events, specifically fish kills or impingement events. To date, no such events have occurred that have required such a report to be submitted for VEGP Units 1 and 2 (NRC 2007a). In addition, during the years when the SRS reactors were operational, no juvenile or adult shortnose sturgeon were collected in the SRS cooling water intake canals, and none were found in SRS impingement studies (Muska and Matthews 1983), despite the fact that, as discussed above, the SRS intakes had much higher withdrawal rates than the VEGP intake. Furthermore, it is unlikely that healthy adult shortnose sturgeon would be impinged given the low through-screen velocity at the VEGP intake (0.7 fps at average river flow [SNC 2007a]) and the adaptation of the sturgeon to swimming in a riverine habitat with swift currents.

Entrainment and impingement data collected at another nuclear power facility in Georgia also are relevant to the evaluation of the effects of these processes on the shortnose sturgeon at VEGP. The Edwin I. Hatch Nuclear Plant (HNP) is similar to VEGP in that it also has two reactors (Units 1 and 2), uses a closed-cycle cooling system with cooling towers, and withdraws makeup water for the cooling system from a single intake structure on a river. It is located on the Altamaha River, which also supports a shortnose sturgeon population that spawns upstream of the facility. The water velocity through the HNP intake screens is 1.9 ft/sec (58 cm/sec) under normal conditions of pumping and river flow (NRC 2000). This is substantially higher than the corresponding velocity through the VEGP intake screens of 0.7 ft/sec (SNC 2007a). No sturgeon larvae were found in entrainment samples from the first two years of HNP Unit 1 operation (1975 and 1976) or the first year of combined HNP Unit 1 and Unit 2 operation (1980). Furthermore, no sturgeon were collected in impingement samples during the first five years of operation (1975 through 1980), and no impinged adults have been collected during operation of the facility subsequently (NRC 2000). Given the similarity of HNP to VEGP and the greater intake velocity at HNP, the lack of shortnose sturgeon entrainment and impingement at HNP provides evidence that these potential causes of mortality also are negligible at VEGP.

The lines of evidence discussed above indicate that the potential for shortnose sturgeon eggs, larvae, juveniles, or adults to be present at the VEGP intake and subject to entrainment or impingement is very low. Based on the small proportion of river water that is withdrawn by VEGP Units 1 and 2 due to their closed-cycle cooling system design, the low through-screen intake velocity, the existence of spawning sites downstream of the site as well as upstream within the middle Savannah River, the affinity of shortnose sturgeon eggs and larvae for the river bottom and main channel, and the lack of entrainment or impingement of shortnose sturgeon recorded at other facilities on the Savannah and Altamaha Rivers, the Staff finds that entrainment or impingement at the VEGP CWIS are not likely to adversely affect the shortnose sturgeon population of the Savannah River.

3.3.3 Thermal Effects

The effluent from the cooling water system for VEGP Units 1 and 2 is discharged into the Savannah River downriver of the CWIS. The NRC staff performed a thermal impact assessment as part of its evaluation of the potential impacts associated with the proposed VEGP Units 3 and 4. Because Units 3 and 4 would produce a thermal discharge very similar to that of Units 1 and 2, the results of the evaluation are applicable to Units 1 and 2 (NRC 2007b).

The assessment used the CORMIX model to estimate the size and temperature of the thermal plume from the existing VEGP Units 1 and 2 as well as the proposed VEGP Units 3 and 4. Assuming conservative conditions (including minimum river temperatures, maximum discharge temperatures, and combining the total effluent from all four VEGP reactor units at a single discharge), the greatest distance the isotherm representing 5°F (2.8°C) above ambient was estimated to extend downstream from the outfall was 97 ft (29.6 m). The isotherm curved downstream with the flow (NRC 2007b).

The maximum width of the 5°F isotherm was 15 ft (4.6 m), and under average flow conditions, the plume was substantially smaller (NRC 2007b). At the proposed location of the Units 3 and 4 outfall, the Savannah River was approximately 312 ft (95.1 m) wide at the Drought Level 3 flow rate. Compared to the width of the river, these results indicate that the size of the thermal plume from the combined effluent discharge would be small. Thus, the thermal plume from the existing discharge from Units 1 and 2 would be smaller and should not impede passage of shortnose sturgeon up and down the river. There are no physical features of the river channel in this area that would prevent sturgeon and other organisms from avoiding the elevated temperatures of the thermal plume as they pass through this part of the river (NRC 2007b). The 1983 BA that evaluated the effects of the SRS L-Reactor on the shortnose sturgeon similarly concluded that passage upstream and downstream was not blocked by thermal effluents from the L-Reactor discharge (Muska and Matthews 1983).

A thermal plume may cause heat shock to fish when the water temperature exceeds the thermal tolerance of the fish. The occurrence of heat shock also is affected by the duration of exposure to high water temperatures. Fish thermoregulate by avoiding extreme temperatures and seeking optimal temperatures (Beyers and Rice 2002). Thus, adult fish can avoid adverse effects from the limited area of the plume. Although it is possible that larvae drifting downstream near the discharge could enter the thermal plume, the small width of the plume within the river channel minimizes the likelihood that larvae may experience high temperatures for sufficient duration to cause substantial mortality.

Cold shock is another factor related to thermal discharges that may affect aquatic biota. Cold shock occurs when aquatic animals that have been acclimated to warm water, such as fish in a power plant's discharge canal, are suddenly exposed to a temperature decrease. Such a situation could occur when a single-unit power plant shuts down suddenly in winter. According to the GEIS (NRC 1996), cold shock mortalities at nuclear power plants in the United States are "relatively rare" and typically involve small numbers of fish. Cold shock is less likely to occur at a plant such as VEGP that has multiple reactor units because the temperature decrease from shutting down one unit is moderated by the heated discharge from the unit that continues to operate. Cold shock also is less likely when the discharge is to a river and the volume of the discharge in comparison to the flow of the river is very small, as is the case at VEGP (NRC 2007b).

Based on this analysis, the Staff concludes that thermal discharges from VEGP Units 1 and 2 would not be likely to adversely affect the shortnose sturgeon population in the Savannah River.

3.3.4 Chemical Toxicity Effects

Shortnose sturgeon in the Savannah River at or downstream of the site potentially could be affected by VEGP operations as a result of the discharge of chemical constituents to surface water of the river. These chemicals include those that are used in the cooling towers, heat exchangers, cooling systems, and sewage treatment system. The facility's cooling water is treated with several chemicals to control biofouling, corrosion, and scaling. The concentrations in the discharge are much lower than the median lethal concentration (LC_{50}) for each chemical. The chemical concentrations are then reduced much further by dilution in the river (NRC 2007b).

The use of chemicals in VEGP Units 1 and 2 is regulated by the facility's NPDES permit, which is administered by the GDNR. The chemical concentrations at the outfall meet the NPDES limits, and no impacts to the aquatic ecology of the Savannah River from these chemicals have been observed. Other than the systems noted above, none of the reactor systems have effluent streams that contain chemicals or biocides, and no change in operations is anticipated. Thus, toxic effects from discharged chemicals would not be likely to adversely affect the shortnose sturgeon population of the Savannah River during the renewal period (NRC 2007b).

3.4 Summary of Shortnose Sturgeon Impacts

The potential for the operation of VEGP Units 1 and 2 to have adverse effects on the shortnose sturgeon was evaluated by the Staff based on multiple lines of evidence regarding water withdrawal from the Savannah River, entrainment and impingement at the cooling water intake, thermal effects in the river from the effluent discharge, and chemical toxicity from the discharge. The evaluation determined that the potential for each of these factors to substantially impact the shortnose sturgeon population of the Savannah River was minimal. Given that compliance with existing water use agreements is expected and that no change in operations is anticipated, the shortnose sturgeon is unlikely to be adversely affected by continued operation of VEGP Units 1 and 2 during the renewal period.

4.0 Conclusions

The NRC Staff reviewed information from the site audit, VEGP's Environmental Report, other reports, and information from the NMFS. The Staff identified the endangered shortnose sturgeon as the only Federally listed species under NMFS jurisdiction that may be present in the vicinity and potentially affected by the VEGP site. The staff has evaluated this species, its known distribution and available habitat, the potential effects of the operation of VEGP on the species, and programs and procedures that VEGP employs to protect the species. Based on this analysis, the Staff has determined that an additional 20 years of operation and maintenance of VEGP and associated transmission lines and ROWs is not likely to adversely affect the shortnose sturgeon population of the Savannah River.

5.0 References

16 U.S.C. Section 1531 to 1544. "Endangered Species Act of 1973" (16 U.S.C. 1531-1544, 87 Stat. 884), as amended. Public Law 93-205, approved December 28, 1973.

32 FR 4001. Secretary of the Interior. "Native Fish and Wildlife, Endangered Species." Federal Register Notice. March 11, 1967.

66 FR 65256. December 18, 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities." *Federal Register.*

Beyers, D. W. and J. A. Rice. 2002. *Evaluating Stress in Fish Using Bioenergetics-Based Stressor-Response Models.* Chapter 8 in Biological Indicators of Aquatic Ecosystem Stress, S. M. Adams, ed. American Fisheries Society.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. "Synopsis of Biological Data on Shortnose Sturgeon, *Acipenser brevirostrum* LeSueur 1818." NOAA Technical Report NMFS 14. National Marine Fisheries Service. October.

Environmental Protection Agency (EPA). 2004. "National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities." Federal Register, Vol. 69, No. 131. July 9, 2004.

Georgia Department of Natural Resources (GDNR). 2007. List of Surface Water Permittees. Accessed at http://www.gaepd.org/Files_PDF/regcomm/wpb/swdmuind.pdf on December 24, 2007.

Marcy, B.C., D. E. Fletcher, F.D. Martin, M.H. Paller, and M.J.M. Reichert. 2005. *Fishes of the Middle Savannah River Basin with Emphasis on the Savannah River Site*. The University of Georgia Press, Athens, Georgia.

McFarlane R.W., R.F. Frietsche and R.D. Miracle. 1978. *Impingement and Entrainment of Fishes at the Savannah River Plant. An NPDES 316b Demonstration.* DP-1494, E.I. Du Pont DE Nemours and Company, Savannah River Laboratory, Aiken, South Carolina.
Meyer J., M. Alber, W. Duncan, M Freeman, C. Hale, R. Jackson, C. Jennings, M. Palta,

Meyer J., M. Alber, W. Duncan, M Freeman, C. Hale, R. Jackson, C. Jennings, M. Palta, E. Richardson, R. Sharitz, J. Sheldon, and R Weyers. 2003. *Summary Report Supporting the Development of Ecosystem Flow Recommendations for the Savannah River below Thurmond Dam.* Summary Report 6/03. University of Georgia, River Basin Center. Accessed at: http://www.rivercenter.uga.edu/publications/pdf/summaryreport.pdf on January 2, 2008.

Muska, C.F. and R.A. Matthews. 1983. *Biological Assessment for the Shortnose Sturgeon, Acipenser brevirostrum, LeSueur 1818, The Savannah River Plant.* DPST-83-754. E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC.

National Marine Fisheries Service (NMFS). 1998. *Recovery Plan for the Shortnose Sturgeon (Acipenser brevirostrum).* Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages.

National Marine Fisheries Service (NMFS). 2006. *Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species, October 1, 2004 – September 30, 2006.* National Oceanic and Atmospheric Administration. Accessed at http://nmfs.noaa.gov/pr/pdfs/laws/esabiennial2006.pdf on February 6, 2008.

National Marine Fisheries Service (NMFS). 2007. Letter from D. M. Bernhart, Assistant Regional Administrator, Protected Resources Division, to R. Franovich, Branch Chief, Environmental Branch B, Division of License Renewal, Office of Nuclear Reactor Regulation, NRC, Washington, DC. Response to letter of August 22, 2007 from NRC requesting information on federally listed, proposed, and candidate species, critical habitat, and designated essential fish habitat in the vicinity of VEGP and its associated transmission line corridors. September 11.

National Oceanic and Atmospheric Administration (NOAA). 2007. "Shortnose Sturgeon (*Acipenser brevirostrum*)." Office of Protected Resources, NOAA Fisheries. Accessed at http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm on December 31, 2007.

Nuclear Regulatory Commission (NRC). 1985. *Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant Units 1 and 2. NUREG-1087, Washington, DC.*

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2, Washington, D.C.

Nuclear Regulatory Commission (NRC). 2000. *Biological Assessment of the Potential Impact on Shortnose Sturgeon Resulting from an Additional 20 Years of Operation of the Edwin I. Hatch Nuclear Power Plant, Units 1 and 2.* In Appendix E of the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Edwin I. Hatch Nuclear Plant, Units 1 and 2* (NUREG 1437, Supplement 4), May 2001.

Nuclear Regulatory Commission (NRC). 2007a. Letter to Mr. David Bernhart, National Marine Fisheries Service Regarding Request for a List of Protected Species and Essential Fish Habitat Within the Area under Evaluation for the Vogtle Electric Generating Plant, Units 1 and 2, License Renewal Application Review. August 22.

Nuclear Regulatory Commission (NRC). 2007b. *Draft Environmental Impact Statement For the Early Site Permit for Two Additional Reactors at the Vogtle Electric Generating Plant.* Docket Nos. 50-424 and 50-425, Georgia Power Company, et al. Washington, D.C. August.

Paller M.H., B.M. Soul, and D.V. Osteen. 1986. *Distribution and Abundance of Ichthyoplankton in the Mid-Reaches of the Savannah River and Selected Tributaries.* DPST-86-798 ECS-SR-27. Prepared for E.I. duPont de Nemours and Company. Savannah River Laboratory, Aiken, South Carolina.

Paller M.H. 1992. *Influence of Savannah River Discharge and Changing SRS Cooling Water Requirements on the Potential Entrainment of Ichthyoplankton at the SRS Savannah River Intakes.* WSRC-RP-92-1 001. Westinghouse Savannah River Co., Aiken, South Carolina. 2008.

Reed, M. B., M. T. Swanson, S. Gaither, J. W. Joseph, and W. R. Henry. 2002. *Savannah River Site at Fifty.* U. S. Government Printing Office. Accessed at: www.srs.gov/general/about/50anniv/50anniv.htm on February 5, 2008.

Southern Nuclear Operating Company, Inc. (SNC). 2006a. "Cooling Water Blowdown Thermal Discharge Analysis for Plant Vogtle Early Site Permit Facility." Southern Company, Birmingham, Alabama. Accession No. ML063000221.

Southern Nuclear Operating Company, Inc. (SNC). 2006b. Vogtle Electric Generating Plant-Units 1 and 2, Final Safety Analysis Report, Revision 13. Burke County, Georgia.

Southern Nuclear Operating Company, Inc. (SNC). 2007a. *Applicant's Environmental Report – Operating License Renewal Stage, Vogtle Electric Generating Plant Units 1 and 2.* Docket Numbers 50-424 and 50-425. June.

Southern Nuclear Operating Company, Inc. (SNC). 2007b. Enclosure 2 to NL-07-2097. Monthly Surface Water Withdrawal Reports, 2006. Contained in: Letter from Tom Tynan, Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission regarding Docket Numbers 50-424 and 50-425: Supplementary Environmental Information to Support the Application for Renewed Operating License for Vogtle Electric Generating Plant Units 1 and 2. NL-07-2097. November 5, 2007.

U.S. Army Corps of Engineers (USACE). 1996. *Water Control Manual: Hartwell, Richard B Russell, and J. Strom Thurmond Projects.* Savannah River Basin, Savannah River District, U.S. Army Corps of Engineers, Savannah, Georgia.

U.S. Army Corps of Engineers (USACE). 2006. *Drought Contingency Plan Update: Savannah River Basin. Draft Environmental Assessment.* Mobile/Savannah Planning Center, Savannah River District, U.S. Army Corps of Engineers, Savannah, Georgia.

U. S. Army Corps of Engineers (USACE). 2007. Concepts of the Savannah River Basin Drought Contingency Plan. Accessed at http://water.sas.usace.army.mil/drought/dcp.cfm on December 24, 2007.

U. S. Army Corps of Engineers (USACE). 2008. Savannah Water Control Home Page, Drought Information, Lake Levels and Projections, Thurmond. Accessed at: http://water.sas.usace.army.mil/cf/KavaPlot/KPlot.cfm on March 4, 2008.

University of Georgia (UGA) Carl Vinson Institute of Government. 2006. Balancing Insteam and Offstream Uses: Instream Flows, Surface Storage and Aquifer Management. A Report to the Georgia Environmental Protection Division. Athens, Georgia.

U.S. Geological Survey (USGS). 2007a. Savannah River Flow near Augusta, Georgia. Accessed at http://waterdata.usgs.gov/nwis/dv on December 24, 2007.

U.S. Geological Survey (USGS). 2007b. Drought Watch - USGS State Information on Drought. Accessed at http://water.usgs.gov/waterwatch on September 14, 2007.

U.S. Geological Survey (USGS). 2007c. Savannah River Flow near Waynesboro, Georgia. Accessed at http://waterdata.usgs.gov/nwis/dv/ on December 4, 2007.

Wike, L. D. 1998. "Potential Effect of Increased SRS River Water Withdrawal on the Savannah River Shortnose Sturgeon Population." WSRC-TR-98-00424. Westinghouse Savannah River Company, Aiken, South Carolina.

Appendix F

GEIS Environmental Issues Not Applicable to Vogtle Electric Generating Plant

Appendix F

GEIS Environmental Issues Not Applicable to Vogtle Electric Generating Plant

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS; NRC 1996, 1999)[(a)] and 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to VEGP

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Impacts of refurbishment on surface water use and quality	1	3.4.1	VEGP does not plan on refurbishment.
Altered salinity gradients	1	4.2.1.2.2, 4.4.2	VEGP does not discharge to saltwater.
Altered thermal stratification of lakes	1	4.2.1.2.3, 4.4.2.2	VEGP does not discharge into a lake.
Water use conflicts (plants with once-through cooling systems)	1	4.2.1.3	VEGP does not have a once-through cooling system.
AQUATIC ECOLOGY (FOR ALL PLANTS)			
Refurbishment impacts to aquatic resources	1	3.5	VEGP does not plan on refurbishment.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Table F-1. (cont'd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	2	4.2.2.1.2, 4.4.3	This issue is related to heat-dissipation systems that are not installed at VEGP.
Impingement of fish and shellfish	2	4.2.2.1.3, 4.4.3	This issue is related to heat-dissipation systems that are not installed at VEGP.
Heat shock	2	4.2.2.1.4, 4.4.4	This issue is related to heat-dissipation systems that are not installed at VEGP.
GROUNDWATER USE AND QUALITY			
Impacts of refurbishment on groundwater use and quality	1	3.4.2	VEGP does not plan on refurbishment.
Groundwater use conflicts (potable and service water, and dewatering; plants that use < 100 gpm)	1	4.8.1.1, 4.8.1.2	VEGP does not use <100 gpm of groundwater for any purpose.
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	VEGP does not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	VEGP does not have or use Ranney wells.
Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	VEGP is not located in a coastal region.
Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	VEGP does not use cooling ponds.
Groundwater quality degradation (cooling ponds at inland sites)	2	4.8.3	VEGP does not use cooling ponds.

Table F-1. (cont'd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
HUMAN HEALTH			
Radiation exposures to the public during refurbishment	1	3.8.1	VEGP does not plan on refurbishment.
Occupational radiation exposure during refurbishment	1	3.8.2	VEGP does not plan on refurbishment.
Electromagnetic fields, chronic effects	NA	4.5.4.2	NRC categorization and impact-findings definitions do not apply.
TERRESTRIAL RESOURCES			
Refurbishment impacts to terrestrial resources	2	3.6	VEGP does not plan on refurbishment.
Cooling pond impacts on terrestrial resources	1	4.4.4	This issue is related to a heat-dissipation system that is not installed at VEGP.
AIR QUALITY			
Air quality during refurbishment (non-attainment and maintenance areas)	2	3.3	VEGP does not plan on refurbishment.
SOCIOECONOMICS			
Public services: education (refurbishment)	2	3.7.4.1	VEGP does not plan on refurbishment.
Off-site land use (refurbishment)	2	3.7.5	VEGP does not plan on refurbishment.
Aesthetic impacts (refurbishment)	1	3.7.8	VEGP does not plan on refurbishment.

F.1 References

10 CFR 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Washington, DC.

Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3, Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report.* NUREG-1437, Volume 1, Addendum 1, Washington, DC.

Appendix G

Severe Accident Mitigation Alternatives (SAMAs) for Vogtle Electric Generating Plant

Appendix G

U.S. Nuclear Regulatory Commission Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Vogtle Electric Generating Plant Units 1 and 2 in Support of License Renewal Application Review

G.1 Introduction

Southern Nuclear Operating Company, Inc. (SNC) submitted an assessment of severe accident mitigation alternatives (SAMAs) for the Vogtle Electric Generating Plant (VEGP) Units 1 and 2 as part of the environmental report (ER) (SNC 2007a). This assessment was based on the most recent VEGP probabilistic risk assessment (PRA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer code, and insights from the VEGP individual plant examination (IPE) (SNC 1992) and individual plant examination of external events (IPEEE) (SNC 1995). In identifying and evaluating potential SAMAs, SNC considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and population dose at VEGP, as well as SAMA candidates for other operating plants which have submitted license renewal applications. SNC identified 16 potential SAMA candidates. This list was reduced to 12 unique SAMAs by eliminating SAMAs that were determined to provide no measurable benefit or have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at VEGP. SNC assessed the costs and benefits associated with each of the potential SAMAs, and concluded that several of the candidate SAMAs evaluated are potentially cost-beneficial.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to SNC by letter dated October 24, 2007 (NRC 2007). Key questions concerned: major plant and modeling changes incorporated within each evolution of the PRA model; justification for the multiplier used for external events; reactor core inventory and population data used in the Level 2 analysis; and further information on several specific candidate SAMAs and low cost alternatives. SNC submitted additional information by letters dated December 20, 2007 (SNC 2007b) and February 1, 2008 (SNC 2008). In the responses, SNC provided: additional information regarding the PRA model development and resultant changes to dominant risk contributors to CDF; additional justification for the treatment of external events; clarification regarding the reactor core inventory and population data; and additional information regarding several specific SAMAs. Additionally, SNC provided results of a revised SAMA analysis (including updated population dose and SAMA benefit estimates) based on several corrections/changes to the SAMA analysis contained in the ER. SNC's responses and revised SAMA analysis addressed the NRC staff's concerns.

An assessment of SAMAs for VEGP is presented below.

G.2 Estimate of Risk for VEGP

SNC's estimates of offsite risk at VEGP are summarized in Section G.2.1. The summary is followed by the NRC staff's review of SNC's risk estimates in Section G.2.2.

G.2.1 SNC's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the VEGP Level 1 and 2 PRA model, which is an updated version of the IPE (SNC 1992), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent VEGP Level 1 and Level 2 PRA model available at the time of the ER, referred to as the VEGL2UP PRA. Subsequent to the ER, the SAMA analysis was revised in response to NRC staff RAIs (SNC 2007b). The scope of the VEGP PRA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 1.55×10^{-5} per year. The CDF is based on the risk assessment for internally-initiated events, which includes internal flooding. SNC did not include the contribution from external events within the VEGP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by effectively doubling the estimated benefits for internal events. This is discussed further in Sections G.2.2 and G.6.2.

The breakdown of CDF by initiating event is provided in Table G-1. This information was provided in response to a staff RAI (SNC 2007b), which also contains a more detailed breakdown. As shown in this table, events initiated by station blackout, loss of offsite power, and loss of nuclear service water are the dominant contributors to CDF. Anticipated transient without scram (ATWS) sequences are insignificant contributors to CDF.

The Level 2 VEGP PRA model that forms the basis for the SAMA evaluation represents an updated version of the original IPE Level 2 model. The current Level 2 model utilizes simplified containment event trees (CETs), containing both phenomenological and systemic events, that are directly linked with the Level 1 accident sequences and linked fault trees from VEGP PRA model Revision 3. The CETs are based on NUREG/CR-6595 (NRC 2004b) and WCAP-16341-P (Westinghouse 2005). WCAP-16341-P was developed by the Westinghouse Owner's Group (WOG) with the intent that Level 2 models developed using its methodology would meet requirements of the American Society of Mechanical Engineers (ASME) PRA standard (ASME 2002).

Table G-1. VEGP Core Damage Frequency

Initiating Event	CDF (Per Year)	% Contribution to CDF
Station Blackout	8.2×10^{-6}	54
Loss of Offsite Power	2.4×10^{-6}	16
Loss of Nuclear Service Water	1.7×10^{-6}	11
LOCA	5.0×10^{-7}	3
Loss of DC Bus	4.3×10^{-7}	3
Loss of 4.16KV Bus	4.0×10^{-7}	3
Loss of Condenser	2.8×10^{-7}	2
Steam Generator Tube Rupture	2.8×10^{-7}	2
Other Transients	2.0×10^{-7}	1
Loss of Feedwater	1.8×10^{-7}	1
Turbine Trip	1.4×10^{-7}	<1
Reactor Trip	1.2×10^{-7}	<1
Spontaneous Reactor Vessel Failure	1.0×10^{-7}	<1
Loss of Seal Injection	9.3×10^{-8}	<1
Secondary Side Steamline Break	8.9×10^{-8}	<1
ATWS	6.2×10^{-8}	<1
Inadvertent SI Injection	6.0×10^{-8}	<1
Interfacing Systems LOCA	3.0×10^{-8}	<1
Loss of ACCW	1.4×10^{-8}	<1
Loss of 120V AC Panels	9.8×10^{-9}	<1
Loss of Instrument Air	3.7×10^{-9}	<1
Total CDF (internal events)	$\mathbf{1.55 \times 10^{-5}}$	**100**

The result of the Level 2 model is a set of eleven release categories with their respective frequency and release characteristics. The categories were defined based on the timing and magnitude of the release and whether the containment remains intact or is bypassed. Each Level 2 end state was assigned to one of the 11 release categories. The results of this analysis for VEGP are provided in Section F.2.2 of the ER (SNC 2007a). The frequency of each release category was obtained by summing the frequency of the individual Level 2 sequences assigned to each release category. The release characteristics for the LERF and non-LERF release categories are based on Modular Accident Analysis Program (MAAP) analyses. The release categories and their frequencies and release characteristics are presented in Table F.3-2 of the ER.

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within an 80-kilometer (50-mile) radius) for the year 2040, emergency response evacuation modeling, and economic data. The magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on information provided in NUREG/BR -0184 (NRC 1997a).

SNC estimated the dose to the population within 80 kilometers (50 miles) of the VEGP site to be approximately 0.0156 person-sievert (Sv) (1.56 person-rem) per year (SNC 2007b). The breakdown of the total population dose by containment release mode is summarized in Table G-2. Containment over-pressure failures and containment bypass sequences, such as a steam generator tube rupture (SGTR) accidents, are the dominant contributors to population dose risk at VEGP.

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] Per Year)	% Contribution
Intact containment	Negligible	<1
Containment isolation failure	0.019	1
Containment bypass - ISLOCA (early)	0.166	11
Containment bypass - SGTR (early)	0.337	22
Containment bypass - SGTR (late)	0.198	13
Containment over-pressure failure (late)	0.587	37
Basemat melt-through (late)	0.248	16
Total CDF	**1.56**	**100**

[1]One person-Rem = 0.01 person-Sv

G.2.2 Review of SNC's Risk Estimates

SNC's determination of offsite risk at VEGP is based on the following major elements of analysis:

- The Level 1 and 2 risk models that form the bases for the 1992 IPE submittal
- (SNC 1992), and the external event analyses of the 1995 IPEEE submittal (SNC 1995),
- The major modifications to the IPE model that have been incorporated in the VEGL2UP PRA update, and
- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PRA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of SNC's risk estimates for the SAMA analysis, as summarized below.

The NRC staff's review of the VEGP IPE is described in an NRC report dated April 15, 1996 (NRC 1996). Based on a review of the IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of GL 88-20 (NRC 1988); that is, the licensee's IPE process is capable of identifying severe accident risk contributors or vulnerabilities. The IPE did not identify any severe accident vulnerabilities associated with either core damage or poor containment performance.

Although no vulnerabilities were identified in the IPE, several improvements to plant procedures were identified. These improvements have been implemented (SNC 2007a).

There have been five revisions to the IPE model since the 1992 IPE submittal, including a 1998 change (Revision 0) in modeling techniques and software, an extensive revision of the model in 2006 (Revision 3) in partial response to the WOG peer review, and a revision in 2006 (VEGPL2UP) that includes the first major update of the full Level 2 model since the IPE. The VEGPL2UP model reflects the VEGP configuration and design as of August 2004, but SNC indicated that no major physical plant or procedure changes have occurred since that time and the model reflects the current as-built, as-operated condition of the plant. A comparison of internal events CDF between the 1992 IPE and the current PRA model indicates a decrease of approximately 70 percent (from 4.9×10^{-5} per year to 1.55×10^{-5} per year). SNC attributes the decrease to a reduction in transient event frequency and crediting the switchyard of plant Wilson for alternate AC power source. A comparison of the contributors to the total CDF indicates that some have increased while others have decreased. A summary listing of those changes that resulted in the greatest impact on the internal events CDF was provided in response to a staff request for additional information and is summarized in Table G-3 (SNC 2007b).

The CDF value from the 1992 IPE submittal (4.9×10^{-5} per year, including a contribution from internal flooding events of less than 2×10^{-11} per year) is near the average of the CDF values reported in the IPEs for PWR plants with dry containments. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events for these plants ranges from 9×10^{-8} to 8×10^{-5} per year, with an average CDF for the group of 2×10^{-5} per year (NRC 1997b). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal event CDF result for VEGP

(1.55×10^{-5} per year, including internal flooding) is comparable to that for other plants of similar vintage and characteristics.

Table G-3. VEGP PRA Historical Summary

PRA Version	Summary of Changes from Prior Model	CDF (per year)
1992 IPE	IPE Submittal	4.90×10^{-5}
1998 Revision 0	- Added credit for Plant Wilson (SBO recovery) - Added of maintenance basic events to facilitate maintenance rule (MR) analysis - Modularized some sub-fault trees, removed unused logic, and corrected minor errors	3.62×10^{-5}
1999 Revision 1	- Enhanced treatment of operator action dependency, removed circular logic, and corrected minor errors	Not Reported
2000 Revision 2	- Updated plant-specific failure data for initiating event frequencies, component failure, and maintenance unavailabilities using data collected up to 1998 - Added new WOG-identified RCP seal LOCA failure modes - Improved recovery tree for recovery analysis	1.48×10^{-5}
2001 Revision 2c	- Updated initiating event frequencies using recent generic data source (NRC 1999) - Removed some SGTR scenarios as LERF scenarios - Removed circular logic in normal charging pump fault trees - Enhanced DC support fault tree for emergency diesel generators - Resolved some Level B Facts and Observations (F&Os) from WOG PRA peer review - Removed small size containment penetrations (2 to 4" in diameter) from LERF logic	1.60×10^{-5}
2006 Revision 3	- Resolved remaining Level B F&Os from WOG peer review - Incorporated plant changes (design and procedural) through the end of 2004 - Redefined initiating events definitions (internal events) to better reflect VEGP-specific situations - Revised event trees based on latest VEGP procedures and MAAP analyses - Modeled SBO using 5 different event trees depending on RCP seal leak rates and stuck open pressurizer (PZR) valves - Developed fully integrated event tree/fault tree models for	1.28×10^{-5}

PRA Version	Summary of Changes from Prior Model	CDF (per year)
	Interfacing System LOCAs - Updated the frequency of VEGP initiating events using VEGP event data collected for the period 1995-2004 and NRC data - Updated maintenance unavailability of major components using data collected from the beginning of the implementation of maintenance rule through the end of 2004 - Updated common cause failure probabilities using alpha factors from VEGP-specific common cause failure analysis - Updated human error probabilities using EPRI HRA Calculator and enhanced the treatment of dependency among operator actions	
2006 VEGPL2UP	- Developed full level 2 fault tree modeling using direct Level1 and Level 2 logic coupling (WCAP-16341-P) - Added containment penetrations (2 to 4" in diameter) back to containment isolation failure tree for LERF - Corrected RCP seal failure probabilities	1.55×10^{-5}

The CDF used in the SAMA analysis is based on the risk assessment for internally-initiated events for Unit 1. In response to an RAI, SNC stated that the CDF for Unit 2 is the same as the Unit 1 CDF since there is essentially no difference in the design and operation of Units 1 and 2 (SNC 2007b).

The NRC staff considered the peer reviews performed for the VEGP PRA, and the potential impact of the review findings on the SAMA evaluation. In the ER (SNC 2007a) and in response to an NRC staff RAI (SNC 2007b), SNC described the peer review by the WOG of VEGP PRA Revision 2c. SNC noted that there were no type "A" findings and observations (F&O) and that all type "B" F&Os from the WOG Peer Review have been addressed and incorporated into Revision 3 to the PRA, upon which the VEGPL2UP model is based. SNC also noted that the VEGPL2UP model has been reviewed by an external contractor and reviewed independently by the SNC PRA team.

Given that the VEGP internal events PRA model has been peer-reviewed and the peer review findings were all addressed, and that SNC has satisfactorily addressed NRC staff questions regarding the PRA, the NRC staff concludes that the internal events Level 1 PRA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current VEGP PRA does not include external events. In the absence of such an analysis, SNC used the VEGP IPEEE to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

The VEGP IPEEE was submitted in November 1995 (SNC 1995), in response to Supplement 4 of Generic Letter 88-20. This submittal included a seismic margin analysis, a fire PRA, and a screening analysis for other external events. No fundamental weaknesses or vulnerabilities to severe accident risk in regard to external events were identified. No seismic, fire, high winds, external floods or other external hazard improvements were identified. In a letter dated December 18, 2000, the NRC staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 2000).

The VEGP IPEEE used a focused scope Electric Power Research Institute (EPRI) seismic margins analysis. This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators (EPRI 1991). For this assessment, a detailed walkdown was performed in which components were screened using an overall high confidence of low probability of failure (HCLPF) capacity of 0.3g, the review level earthquake (RLE) value for the plant, and the screening level that would be used for a focused-scope plant. The analysis identified 24 equipment open items for each unit, mostly seismic interaction issues. Corrective actions for 46 of the 48 items have been completed while the remaining 2 items were further evaluated and determined to require no further action (SNC 1998).

The VEGP IPEEE used a scenario-based PRA approach that assessed the risk of core damage induced by fire and smoke hazards in all important plant locations. This approach met the intent of NUREG-1407 (NRC 1991). The analysis was performed in a two phase approach consisting of a spatial interactions analysis and a detailed analysis. In the spatial interactions phase, plant locations (fire zones) were identified and qualitative screening was performed on the basis of functional considerations combined with the absence of fire propagation pathways from the fire zone. Fire and smoke hazard location and propagation scenarios were then developed for each initially unscreened fire zone and quantitative screening was performed based on estimates of core damage frequency, in which all plant components and cabling located in each zone were assumed to be damaged. In the second phase of the analysis, a detailed analysis was performed for the location scenarios retained from the first phase of the analysis. The detailed analysis phase included the development of sub-scenarios, assessment of frequency reduction factors, and relaxation of overly conservative assumptions.

The total fire CDF from the IPEEE was estimated to be 1.01×10^{-5} per year (SNC 2007a). The plant-specific data and model reflect the plant configuration as of October 1993 and is based on Revision 1 of the Vogtle IPE internal events PRA. In response to an RAI, SNC provided information on three additional fire scenarios evaluated in the IPEEE, each having a fire CDF of less than 1.3×10^{-7} per year (SNC 2007b). The dominant fire scenarios and their contributions to the fire CDF are listed in Table G-4.

In the ER, SNC states that the use of the fire analysis results as a reflection of CDF may be inappropriate and that while the fire PRA is generally self-consistent within its calculational framework, the fire analysis does not compare well with internal events PRAs because of the number of conservative assumptions that have been included in the fire analysis process. The ER provides a list of fire analysis topics (involving technical inputs, data and modeling) that prevent the effective comparison of the CDF between the internal events PRA and the fire analysis. In response to an RAI requesting the applicability of the general topics to the VEGP fire analysis (NRC 2007), SNC provided several VEGP-specific examples of conservatisms in the fire analysis, including: potential reduction in fire ignition frequencies, use of generic fire protection system failure rate data, conservative target fire damage assumptions, conservative application of generic COMPBRN results, conservative failure probabilities for human recovery actions, and guaranteed failure of certain systems (SNC 2007b). Although arguments regarding the conservatisms in the fire analysis are presented in the ER and RAI responses, SNC used the baseline fire CDF of 1.01×10^{-5} per year in the SAMA analysis rather than some reduced value.

Table G-4. Fire Scenarios and Their Contribution to Fire CDF

Fire Scenario	Fire Area Description	CDF (per year)
CONT-46	Main Control Room	1.3×10^{-6}
1-CB-LA-G-91-L-F3	Train A 4.16-kV Switchgear Room (small)	7.6×10^{-7}
1-CB-LA-H-92-L-01	Train B 4.16-kV Switchgear Room (large)	6.2×10^{-7}
1-CB-LA-N-85-L-R2	Level A Corridor and Cable Chase (large)	4.2×10^{-7}
1-CB-LA-I-88-L-R2	Train B Electrical Penetration Area (transient)	3.4×10^{-7}
1-CB-LA-R-97-L-G1	Train B Electrical Raceway Room (small)	2.3×10^{-7}
1-CB-LB-A-73-L-R2	Train A Electrical Mezzanine (transient)	2.0×10^{-7}
1-CB-LA-G-91-L-R4	Train A 4.16-kV Switchgear Room (large)	2.0×10^{-7}
1-CB-LA-K-95-L-G2	Train A Lower Cable Spreading Room (cable set 1)	1.7×10^{-7}
1-CB-LA-K-95-L-G3	Train A Lower Cable Spreading Room (cable set 2)	1.7×10^{-7}
1-CB-LB-A-73-L-G1	Train A Electrical Mezzanine (cables)	1.3×10^{-7}
1-CB-LA-I-88-L-G1	Train B Electrical Penetration Area (cables)	1.2×10^{-7}
1-CB-L2-B-120-L-G2	Train B Cable Spreading Room (cables)	1.1×10^{-7}
	All other Scenarios	5.4×10^{-6}
Total Fire CDF		1.01×10^{-5}

The IPEEE analysis of high winds, floods, and other external events followed the screening and evaluation approaches described in Supplement 4 of GL 88-20 (NRC 1991) and did not identify any significant sequences or vulnerabilities (SNC 1995). Based on this result, SNC concluded that these other external hazards would not be expected to impact the conclusions of the SAMA analysis and did not consider specific SAMAs for these events. It is noted that the risks from deliberate aircraft impacts were explicitly excluded since this was being considered in other forums along with other sources of sabotage.

Based on the aforementioned results, SNC estimated that the external events CDF is comparable to, or no higher than, the internal events CDF. This is based on a fire CDF of 1.01 x 10^{-5} per year, which represents just 66 percent of the internal events CDF of 1.55 x 10^{-5} per year, and the argument that fire risk is typically the largest external risk contributor. Accordingly, the total CDF from internal and external events would be approximately 2 times the internal events CDF. In the SAMA analysis submitted in the ER, SNC doubled the benefit that was derived from the internal events model to account for the combined contribution from internal and external events. In response to an RAI requesting additional justification for increasing the internal events CDF by only a factor of 2, SNC provided arguments related to the conservative bias and modeling limitations of the fire analysis, and that the IPEEE identified no potential vulnerabilities to external events (SNC 2007b). The NRC staff agrees with the licensee's overall conclusion concerning the impact of external events and concludes that the licensee's use of a multiplier of 2 to account for external events is reasonable for the purposes of the SAMA evaluation.

The NRC staff reviewed the general process used by SNC to translate the results of the Level 1 PRA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in response to NRC staff requests for additional information (SNC 2007b). The Level 2 model utilizes event trees based on NUREG/CR-6595 (NRC 2004b) and WCAP-16341-P (Westinghouse 2005), containing both phenomenological and systemic events, which are linked directly to the Level 1 event trees. WCAP-16341-P was developed by the WOG with the intent that Level 2 models developed using its methodology would meet Capability Category II requirements of the American Society of Mechanical Engineers (ASME) PRA standard (ASME 2002), which includes the use of plant-specific data and models for the dominant contributors to CDF and the ability to identify the relative importance of the dominant contributors at the component level. Each Level 1 core damage sequence was evaluated using five attributes: (1) is AC power available, (2) is the containment bypassed, (3) is the containment isolated, (4) is reactor coolant system (RCS) pressure high or low, and (5) are all steam generators wet. After assignment of attributes, the Level 1 sequences were assigned to Level 2 event sequences using a defined set of logic rules.

SNC characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 11 release categories, defined based on the timing and magnitude of the release and whether the containment remains intact or is bypassed. Each Level 2 end state was assigned to one of the 11 release categories. The frequency of each release category was obtained by summing the frequency of the individual Level 2 sequences assigned to each release category. The release characteristics for the LERF and non-LERF release categories are based on Modular Accident Analysis Program (MAAP) analyses. The release categories and their frequencies and release characteristics are presented in Table F.3-2 of the ER.

The NRC staff's review of the Level 2 IPE concluded that it addressed the most important severe accident phenomena normally associated with large, dry containments, and identified no significant problems or errors (NRC 1996). Based on the NRC staff's review of the Level 2 methodology, the fact that the updated Level 2 model was reviewed by an external contractor and independently reviewed by the SNC PRA team, and the responses to the RAIs concerning the changes to the Level 2 model since the WOG peer review, the NRC staff concludes that the Level 2 PRA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

The reactor core radionuclide inventory used in the consequence analysis contained in the ER corresponds to the end-of-cycle values for VEGP at 3565 MWt. This was evaluated in 1990 using the ORIGEN code. All releases were modeled as occurring at ground level, and buoyant plume rise was not modeled. SNC assessed the impact of alternatively assuming an elevated release and a heated (buoyant) plume. The results of this sensitivity study showed that a maximum elevated release produces about a 10 percent increase in population dose-risk, and a bounding high plume heat produces about a 14 percent increase in population dose-risk.

In response to an RAI (SNC 2007b), SNC provided results of a revised SAMA analysis which accounted for the planned 1.7 percent power uprate (to 3698 MWt) for VEGP, as well as several additional changes to the ER SAMA analysis, as described in Section G.6.1. The results of the revised analysis are reflected in the population dose values reported in Table G-2 and in the benefit estimates reported later in Table G-5.

The NRC staff reviewed the process used by SNC to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3 PRA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within an 80-kilometer (50-mile) radius for the year 2040, emergency evacuation modeling, and economic data. This information is provided in Attachment F of the ER.

SNC used site-specific meteorological data for the 1999 calendar year as input to the MACCS2 code. The data were collected from the onsite meteorological tower. Data from 1998 through 2002 were also considered, but the 1999 data were chosen because they were the most complete and because results of a MACCS2 sensitivity analysis indicated that the 1999 data produced slightly more conservative results than the data sets for the other years. Missing data were obtained by either using corresponding data from another level, interpolating if the data gap was less than 4 hours, or using data for a similar day/hour from a previous year. The NRC staff notes that previous SAMA analyses results have shown little sensitivity to year-to-year differences in meteorological data and concludes that the use of the 1999 meteorological data in the SAMA analysis is reasonable.

The population distribution the licensee used as input to the MACCS2 analysis was estimated for the year 2040, based on the U.S. Census Bureau population data for 2000, as provided by the SECPOP 2000 program (NRC 2003), and the expected annual population growth rate. The baseline population was determined for each of sixteen directions and each of ten concentric rings (total of 160 sectors) out to a radius of 50 miles surrounding the site. The transient population within 10 miles of the site was included. The county-level census data were used to estimate the annual population growth rate for each of the 160 sectors (USCB 2000a and 2000b). The county population was proportioned within each sector by the fractional area of each county within each sector. Population projections were based on the county growth rates, with the fraction of each county in each sector determining the sector growth rate. The NRC staff considers the methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 16 kilometers (10 miles) from the plant. Based on information in the ER and in response to an RAI (SNC 2007b), it was assumed that 95 percent of the population would evacuate. This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone (EPZ). The evacuation time used in the SAMA analysis was based on a projection for the year 2040. The evacuation speed for year 2010 was estimated to be approximated 3.2 meters per second with a delayed start time of 42 minutes. This speed is derived from the time to evacuate the entire EPZ under adverse weather conditions for the year 2010, which is the year for which the evacuation time estimate was performed (IEM 2006). The evacuation speed was projected to year 2040 by assuming that year 2010 traffic was at maximum throughput and no new roads would be constructed. The 2040 evacuation speed was estimated to be 2.2 meters per second, based on the 2010 speed multiplied by the ratio of the 2010 to 2040 populations within the EPZ. A sensitivity analysis was performed in which the evacuation speed was not adjusted to year 2040 (i.e., the speed was increased from 2.2 to 3.2 meters/second). The result was a 1 percent decrease in the total population dose, which is insignificant (SNC 2007a). The NRC staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data was provided from SECPOP2000 (NRC 2003) by specifying the data for each of the counties surrounding the plant to a distance of 50 miles. SECPOP2000 utilizes economic data from the 1997 Census of Agriculture (USDA 1998). In addition, generic economic data that applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. Some of this data was adjusted using cost escalation factor of 1.84. This was applied to parameters describing the cost of evacuating and relocating people, land decontamination, and property condemnation. The scaling factor is taken from the U.S. department of Labor, Bureau of Labor Statistics (BLS) Inflation Calculator from year 1984 to 2006. Other escalation factors (e.g., farm and non-farm wealth for the area surrounding VEGP) were similarly extrapolated based on the reference year of the data. In response to an RAI (SNC 2007b), the farm wealth escalation factor was identified as being in error in the original SAMA analysis and was corrected in the revised SAMA analysis.

In response to another RAI (SNC 2007b), SNC addressed the impact on the SAMA analysis of three recently reported problems with SECPOP2000. These errors are: (1) inconsistency in the format in which several economic parameters were output from the SECPOP2000 code and input to the MACCS2 code, (2) an error that resulted in use of agricultural/economic data for the wrong counties in the SECPOP2000 calculations, and (3) an error that resulted in the economic data for some counties being handled incorrectly. (The first of these errors was identified prior to the ER but not fully reflected in the baseline risk estimates provided in the ER. The two remaining errors were identified subsequent to the ER.) The results of a revised SAMA analysis reflecting these corrections was provided in response to the RAI.

The NRC staff concludes that the methodology used by SNC to estimate the offsite consequences for VEGP provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and revised offsite doses reported by SNC.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by SNC are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

SNC's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- Review of the most significant basic events from the current, plant-specific PRA,

- Review of potential plant improvements identified in the VEGP IPE and IPEEE,

- Review of dominant fire areas from the fire analysis and SAMAs that could potentially reduce the associated fire risk,

- Review of Phase II SAMAs from license renewal applications for six other U.S. nuclear sites, and

- Review of other industry documentation discussing potential plant improvements.

Based on this process, an initial set of 16 candidate SAMAs, referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, SNC performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA was determined to provide no measurable benefit, or

- The SAMA has estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at VEGP.

Based on this screening, 4 SAMAs were eliminated leaving 12 for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table F.6-1 of the ER (SNC 2007a). In Phase II, a detailed evaluation was performed for each of the 12 remaining SAMA candidates, as discussed in Sections G.4 and G.6 below. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of 2.

G.3.2 Review of SNC's Process

SNC's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events, but also included explicit consideration of potential SAMAs for fire events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth (RRW) perspectives at VEGP, and included selected SAMAs from prior SAMA analyses for other plants.

SNC provided a tabular listing of the PRA basic events sorted according to their RRW (SNC 2007a). SAMAs impacting these basic events would have the greatest potential for reducing risk. SNC used a RRW cutoff of 1.02, which corresponds to about a two percent change in CDF given 100-percent reliability of the SAMA. This equates to a benefit of approximately $20,000 (after the benefits have been multiplied to account for external events). SNC also provided and reviewed the large early release frequency (LERF)-based RRW events down to a RRW of 1.02. SNC correlated the basic events with highest risk importance in the Level 1 and 2 PRA with the SAMAs evaluated in Phase I or Phase II, and showed that, with a few exceptions, all of the significant basic events are addressed by one or more SAMAs (SNC 2007a). Of the basic events of high risk importance that are not addressed by SAMAs, each is closely tied to other basic events that had been addressed by one or more SAMAs.

For a number of the Phase II SAMAs listed in the ER, the information provided did not sufficiently describe the proposed modification. Therefore, the NRC staff asked the applicant to provide more detailed descriptions of the modifications for several of the Phase II SAMA candidates (NRC 2007). In response to the RAI (SNC 2007b), SNC provided the requested information (SNC 2007b).

SNC did not identify or evaluate any Phase I SAMAs in the ER that reduce the magnitude of releases from SGTR events, which are a dominant contributor to population dose risk and economic cost risk at VEGP. In response to an RAI (SNC 2007b), SNC evaluated several SAMAs from ER Table A-1 that would reduce the source term released during SGTR events. SNC indicated that all of the alternatives identified in the RAI are either: not applicable, effectively already implemented or already addressed by existing plant procedures, or not effective at VEGP (SNC 2007b).

SNC identified and evaluated a number of Phase I and II SAMAs in the ER that address RCP seal LOCAs, one of the largest contributors to the internal events CDF at VEGP. In response to an RAI (SNC 2007b), SNC evaluated several lower cost, procedure-only SAMAs from ER Table A-1 that also addressed RCP seal LOCAs. SNC indicated that all of the alternatives identified in

the RAI are either not applicable, effectively already implemented or already addressed by existing plant procedures, or not effective at VEGP (SNC 2007b).
The NRC staff questioned SNC about other lower cost alternatives to some of the SAMAs evaluated (NRC 2007), including:

- Enhancing procedures to direct PCS cooldown on loss of RCP seal cooling, which was determined to be potentially cost-beneficial at another PWR plant.

- Proceduralizing local manual operation of auxiliary feedwater when control power is lost, which was determined to be potentially cost-beneficial at another PWR plant.

- Using a portable generator to provide backup power to selected instrumentation and to the turbine-driven auxiliary feedwater pump controls, thereby extending the ability of the plant to cope with loss of AC power events.

- Providing alternate DC feeds (using a portable generator) to panels supplied only by DC bus, as an alternative to SAMAs 5 and 8

- Modifying emergency procedures to isolate a faulted SG due to a stuck open safety valve.

- Providing hardware connections to allow service water to cool normal charging pump (NCP) seals, as an alternative to SAMA 1.

In response to an RAI (SNC 2007b), SNC addressed the suggested lower cost alternatives (SNC 2007b). This is discussed further in Section G.6.2.

Although no vulnerabilities were identified in the IPE, several procedural improvements were identified and subsequently implemented by the plant (SNC 2007a). These enhancements included: (1) revising procedures for operators to open doors to important electrical equipment rooms following loss of cooling to obtain natural circulation to cool the rooms; (2) changing the loss of all AC power procedure so operators attempt local manual operation of the turbine driven auxiliary feedwater pump (TDAFW) upon loss of DC power; and (3) revising the procedure for loss of the nuclear service cooling water systems (NSCW) to have operators reduce heat loads to support cooling of reactor coolant pump seals while single NSCW pump operation is established (NRC 1996).

Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER, together with those identified in supplemental information to the ER and in response to NRC staff RAIs, addresses the major contributors to internal event CDF.

SNC did not identify VEGP-specific candidate SAMAs for seismic events. In the VEGP IPEEE seismic analysis, both VEGP Units 1 and 2 have a HCLPF capacity of at least 0.3g. Also, as noted in Section 2.2, 24 minor equipment open items, mostly seismic interaction issues, were originally identified. They included a gap between the battery rack end rails and batteries, and potential interactions between the diesel generators and crane controller. As noted in the ER, all of these issues have been addressed, as documented in a letter to the NRC dated March 31, 1998 (SNC 1998). The NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored and that it is unlikely that there are any cost-beneficial, seismic-related SAMA candidates.

The IPEEE did not identify opportunities for improvements related to fire events (SNC 1995). Nevertheless, SNC considered potential SAMAs for fire events, and determined that four of the Phase I SAMAs identified based on internal events risk also mitigate the fire risk (e.g., SAMAs 5, 6, 8, and 11). Although these four SAMAs contribute to the reduction in fire risk, no SAMAs unique to the fire analysis were identified. In response to an RAI on the potential for SAMAs that could reduce the fire initiators, improve fire detection or suppression, or relocate components or cabling, SNC stated that the IPEEE concluded that no plant improvement to reduce fire risk is necessary because of the relatively low fire risk impact to the operations at VEGP (SNC 2007b). The NRC staff concludes that the opportunity for fire-related SAMAs has been adequately explored and that it is unlikely that there are any cost-beneficial, fire-related SAMA candidates.

The NRC staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that SNC used a systematic and comprehensive process for identifying potential plant improvements for VEGP, and that the set of potential plant improvements identified by SNC is reasonably comprehensive and therefore acceptable. This search included reviewing insights from the plant-specific risk studies, and reviewing plant improvements considered in previous SAMA analyses. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the absence of external event vulnerabilities reasonably justifies examining primarily the internal events risk results for this purpose.

G.4 Risk Reduction Potential of Plant Improvements

SNC evaluated the risk-reduction potential of the 12 remaining SAMAs that were applicable to VEGP. The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. Such bounding calculations overestimate the benefit and are conservative.

SNC used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the VEGP PRA (version VEGPL2UP) model. The changes made to the model to quantify the impact of SAMAs are detailed in Section F.6 of Attachment F to the ER (SNC 2007a). Table G-5 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The estimated benefits reported in Table G-5 reflect the combined benefit in both internal and external events, as well as a number of changes to the analysis methodology subsequent to the ER. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction estimates of certain SAMAs provided in the ER (NRC 2007). For example, the NRC staff requested the bases for the assumption for SAMA 11 that 90 percent of all loss of nuclear service cooling water (NSCW) scenarios are avoided (i.e., 10 percent of loss of NSCW scenarios still proceed to core damage). The licensee clarified that very quick operator action would be required to prevent a reactor coolant pump (RCP) seal LOCA and, additionally, a loss of NSCW has other deleterious effects on VEGP systems that could still result in core damage even without the seal LOCA. The licensee also provided a qualitative argument that the cost-risk assessment is not particularly sensitive to changes in probability of avoiding loss of NSCW above 90 percent, as this value will provide 90 percent of the SAMA benefit. The NRC staff considers the assumptions, as clarified, to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff has reviewed SNC's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on SNC's risk reduction estimates.

Table G-5. SAMA Cost/Benefit Screening Analysis for VEGP[(a)]

SAMA	Assumptions	% Risk Reduction: CDF	% Risk Reduction: Population Dose	Total Benefit Using 7% Discount Rate[(b)] ($)	Total Benefit Using 3% Discount Rate[(b)] ($)	Cost ($)
1 - Permanent, self-powered pump to backup NCP	Modify event tree to include pump having a hardware and operator error failure probability of 1.0E-1.	48	17	348,000	423,000	2,700,000
2 - Maintain full-time black start capability of the Wilson Switchyard combustion turbines	**Include credit for the availability of the black start Plant Wilson CTs (and black start DGs) all the time. The black start CTs and DGs were assumed to have a failure probability of 5.0E-02.**	**43**	**37**	**336,000**	**414,000**	**25,000**
4 - AC cross-tie capability	**Reduce human error probabilities for cross-tying to the opposite unit EDG within 7 hours after an SBO by a factor of 2 and after 7 hours by a factor of 1.6.**	**22**	**19**	**171,000**	**211,000**	**25,000**
6 - Add bypass line around NSCW CT return valves	**Modify event tree to include a bypass line and valve, around each CT tower return line isolation valve, having a failure probability of 6.26E-3, a common cause failure probability of 2.66E-4, and an actuation signal failure probability of 3.69E-3.**	**32**	**16**	**241,000**	**294,000**	**816,000[(c)]**
7 - Implement enhanced RCP seal design	Completely eliminate RCP seal leakage events greater than 21 gpm.	53	19	384,000	468,000	1,050,000

Table G-5. (cont'd)

SAMA	Assumptions	% Risk Reduction: CDF	% Risk Reduction: Population Dose	Total Benefit Using 7% Discount Rate[b] ($)	Total Benefit Using 3% Discount Rate[b] ($)	Cost ($)
9 - Implement automatic initiation of HPI on low RCS level after AC recovery during an SBO	Modify event tree to include HPI auto initiation system having a probability of failure of 6.42E-4.	3	1	21,000	25,000	250,000
10 - Additional training and/or procedural enhancement to implement timely RCS depressurization	Completely eliminate delayed RCS depressurization in both Level 2 SBO and non-SBO event trees.	0	2	5,000	7,000	25,000
11 - Use hydrostatic test pump as an alternate means of providing seal injection	Eliminate 90% of all Loss of NSCW events.	10	4	74,000	91,000	520,000[c]
12 - Ensure all ISLOCA releases are scrubbed	Completely eliminate all ISLOCA events.	~0	9	14,000	20,000	>100,000
13 - Completely automate swap over to recirculation on RWST depletion	Reduce human error probabilities for all basic events that refer to high pressure injection to a negligible value (1.00E-05).	2	3	14,000	18,000	>100,000
14 - Install additional instrumentation for ISLOCA detection	Completely eliminate all ISLOCA events.	~0	9	14,000	20,000	425,000
15 - Install permanent dedicated generator for NCP	Modify event tree to include pump having a hardware and operator error failure probability of 1.0E-1.	48	17	348,000	423,000	900,000

Table G-5. (cont'd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate[b] ($)	Total Benefit Using 3% Discount Rate[b] ($)	Cost ($)
		CDF	Population Dose			
16 - Enhance procedures for ISLOCA response	**Completely eliminate all ISLOCA events.**	**~0**	**9**	**14,000**	**20,000**	**25,000**

(a) SAMAs in bold are potentially cost-beneficial
(b) Estimated benefits reflect revised values provided after correction of three SECPOP2000 economic data file errors, corrected escalation factor for farm wealth, and corrected source term inventory and replacement power cost to reflect proposed 1.7 percent power uprate (SNC 2007b, SNC 2008)
(c) Estimated costs reflect revised values provided in response to RAIs (SNC 2007b)

G.5 Cost Impacts of Candidate Plant Improvements

SNC estimated the costs of implementing the 12 candidate SAMAs through the application of engineering judgment, and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they generally include contingency costs associated with unforeseen implementation obstacles (SNC 2007a, SNC 2008). The cost estimates provided in the ER did not account for inflation, which is considered another conservatism. For those cost estimates that were developed for a dual-unit SAMA analysis, SNC reduced the estimated costs by half so that all cost estimates were on a "per unit" basis.

The NRC staff reviewed the bases for the applicant's cost estimates (presented in Section F.6 of Attachment F to the ER). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. In response to an RAI requesting a more detailed description of the changes associated with SAMAs 1, 6, 7, 9, 12, and 13, SNC provided additional information detailing the analysis and plant modifications included in the cost estimate of each improvement (SNC 2007b). In the response to the RAI, SNC provided a revised cost estimate for SAMA 6, add bypass line around NSCW cooling tower (CT) return valves, of $816,000. The staff reviewed the costs and found them to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The NRC staff requested additional clarification on the estimated cost of $580,000 for implementation of SAMA 11, use hydrostatic test pump as an alternate means of providing seal injection, when the cost estimate for this same SAMA for the V.C. Summer plant was only $150,000 (NRC 2007). In response to the RAI (SNC 2007b), SNC further described this modification as involving the installation of additional piping, valves, pumps, and controls. SNC also provided the bases for a revised cost estimate of $520,000. Based on this additional information, the NRC staff considers the estimated cost of $520,000 to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff concludes that the cost estimates provided by SNC are sufficient and appropriate for use in the SAMA evaluation.

G.6 Cost-Benefit Comparison

SNC's cost-benefit analysis and the NRC staff's review are described in the following sections.

G.6.1 SNC's Evaluation

The methodology used by SNC was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a). The guidance involves determining the net value for each SAMA according to the following formula:

Appendix G

Net Value = (APE + AOC + AOE + AOSC) - COE where,
APE = present value of averted public exposure ($)
AOC = present value of averted offsite property damage costs ($)
AOE = present value of averted occupational exposure costs ($)
AOSC = present value of averted onsite costs ($)
COE = cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. SNC's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3 percent and one at 7 percent (NRC 2004a). SNC provided both sets of estimates (SNC 2007a, SNC 2007b, SNC 2008).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem per year)
x monetary equivalent of unit dose ($2000 per person-rem)
x present value conversion factor (15.04 based on a 20-year period with a 3-percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997a), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, which assumes elimination of all severe accidents due to internal events, SNC calculated an APE of approximately $46,900 for the 20-year license renewal period.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction
x offsite economic costs associated with a severe accident (on a per-event basis)
x present value conversion factor.

For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, SNC calculated an annual offsite economic risk of about $2,000 based on the

Level 3 risk analysis. This results in a discounted value of approximately $30,100 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor.

SNC derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997a). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 3 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, SNC calculated an AOE of approximately $9,600 for the 20-year license renewal period.

Averted Onsite Costs

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. SNC derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook (NRC 1997a).

SNC divided this cost element into two parts – the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, SNC calculated an ACC of approximately $302,000 for the 20-year license renewal period.

Appendix G Appendix G

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor

SNC based its calculations on the value of 1253 megawatt electric (MWe), which includes the proposed 1.7 percent power uprate for VEGP. Therefore, SNC applied a power scaling factor of 1253/910 to determine the replacement power costs. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, SNC calculated an RPC of approximately $118,000 for the 20-year license renewal period. For the purposes of initial screening, which assumes all severe accidents are eliminated, SNC calculated the AOSC to be approximately $420,000 for the 20-year license renewal period.

Using the above equations, SNC estimated the total present dollar value equivalent associated with completely eliminating severe accidents from internal events at VEGP to be about $507,000 for a single unit. Use of a multiplier of 2 to account for external events increases the value to $1,014,000 and represents the dollar value associated with completely eliminating all internal and external event severe accident risk for a single unit at VEGP, also referred to as the Modified Maximum Averted Cost Risk (MMACR).

<u>SNC's Results</u>

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 3 percent discount rate), SNC identified two potentially cost-beneficial SAMAs. The potentially cost-beneficial SAMAs are:

- SAMA 2 - Maintain full-time black start capability of the Plant Wilson combustion turbines.

- SAMA 4 - Prepare procedures and operator training for cross-tying an opposite unit DG.

SNC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (SNC 2007a). If the benefits are increased by a factor of 2 to account for uncertainties, two additional SAMA candidates were determined to be potentially cost-beneficial:

- SAMA 6 - Implementation of a bypass line for the cooling tower return isolation valves.

- SAMA 16 - Enhance procedures for ISLOCA response.

Subsequent to the ER, and in response to NRC staff RAIs, SNC provided revised population dose and SAMA benefit estimates based on several corrections/changes to the SAMA analysis contained in the ER, as summarized below (SNC 2007b):

- Correction to one SECPOP2000 input/output error that was not fully reflected in the ER SAMA analysis, and corrections to two input/output errors related to the SECPOP2000 code that were identified subsequent to the ER,

- An increase in reactor core radionuclide inventory and replacement power costs to reflect a proposed 1.7 percent power uprate for VEGP that was not accounted for in the ER SAMA analysis,

- Use of a revised offsite population dose risk of 1.56 person-rem per year instead of a value of 2.04 person-rem per year referenced in the ER,

- Use of a revised offsite economic cost risk of $2,003 instead of a value of $1,412 referenced in the ER, and

- Use of a revised farm wealth escalation factor of 1.256 instead of 1.095 utilized in the ER SAMA analysis.

SNC provided revised population dose and benefit estimates reflecting the results of these corrections/changes (SNC 2007b). The population dose and SAMA benefit estimates reported in the present document (e.g., in Tables G-2 and G-5) reflect these revisions. The revised analysis produced an insignificant change to the MMACR (i.e., a 0.4 percent decrease, from $1.018M to $1.014M), and a change in the estimated benefits for the various SAMAs ranging from a 1.0 percent reduction to a 3.4 percent increase. These changes resulted in no impact on the Phase I screening results, or on the list of SAMAs determined to be potentially cost-beneficial in the baseline and uncertainty analyses. Thus, the overall results of the SAMA assessment were not affected (SNC 2007b).

The potentially cost-beneficial SAMAs, and SNC's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of SNC's Cost-Benefit Evaluation

The cost-benefit analysis performed by SNC was based primarily on NUREG/BR-0184 (NRC 1997a) and was executed consistent with this guidance.

To account for external events, SNC multiplied the internal event benefits by a factor of 2 for each SAMA. Given that the CDF from internal fires and other external events as reported by SNC is less than the CDF for internal events, the NRC staff agrees that the factor of 2 multiplier for external events is reasonable.

SNC considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. In the absence of a detailed uncertainty

Appendix G

distribution from the VEGP PRA model, SNC applied an additional multiplier of 2 to the internal and external event benefit estimates, which is representative of the ratio of the 95th percentile CDF to the mean CDF in typical PRA uncertainty calculations. SNC reexamined the initial set of SAMAs to determine if any additional Phase I SAMAs would be retained for further analysis if the benefits (and Modified Maximum Averted Cost-Risk) were increased by a factor of 2. One such Phase I SAMA was identified, i.e., SAMA 5 - permanent, dedicated generator for one motor driven AFW pump and a battery charger.

SNC also considered the impact on the Phase II screening if the estimated benefits were increased by a factor of 2 (in addition to the multiplier of 2 for external events). The additional Phase I SAMA, SAMA 5 as described above, was included in this sensitivity analysis. Two additional SAMAs became cost-beneficial in SNC's analysis (SAMAs 6 and 16 as described above). However, SNC concluded that neither of these SAMAs was likely to be cost-beneficial because not all required equipment and material had been included in the cost estimate for SAMA 6, and because the full calculated benefit of SAMA 16 was unlikely to be achievable since procedures to deal with ISLOCA events already exist at VEGP.

The NRC staff questioned why these two SAMAs shouldn't continue to be considered for implementation at VEGP since the factor of 2 is not demonstratively conservative (this factor is reported to be as high as 2.5 for other Westinghouse plants and as high as 5 for other plants) (NRC 2007). In response to the RAI, SNC provided a revised implementation cost estimate for SAMA 6 of $816,000 that included additional costs for an inverter, heavy gauge cabling, and additional pipe supports. Based on the revised cost estimate, SAMA 6 would no longer be cost-beneficial (SNC 2007b).

SNC's response on SAMA 16 was that the relatively low potential cost-benefit of $14,500 and the fact that procedures to deal with ISLOCA events already exist at VEGP made this SAMA an unlikely candidate for implementation (SNC 2007b). The staff agrees that the benefits of this SAMA are only slightly greater than its estimated implementation costs, and that the risk reduction provided by this SAMA would be relatively small. Furthermore, since VEGP already has a plant procedure to deal with ISLOCA events and recognizing that the assumption that all ISLOCA events are eliminated is conservative, the staff agrees that further evaluation of this SAMA by SNC is not warranted.

The NRC staff questioned the estimated cost of $900,000 for implementation of SAMA 15, install permanent dedicated generator for the normal charging pump (NCP), when a recent cost estimate for this same SAMA for another plant was only $800,000 (NRC 2007). In response to the RAI, SNC reevaluated this SAMA using an implementation cost of $800,000 and determined that this SAMA would be potentially cost-beneficial if analysis uncertainties were taken into account (SNC 2007b). However, SNC noted that if either of low cost SAMAs 2 and 4, which were determined to be potentially cost-beneficial, were implemented at VEGP, the benefit of SAMA 15 would be greatly reduced. The staff agrees that SAMAs 2 and 4 provide much of the same benefit that SAMA 15 does at much lower cost and that further evaluation of this SAMA by SNC is not warranted.

The NRC staff asked the licensee to evaluate several lower cost alternative SAMAs that had been found to be potentially cost-beneficial at other PWR plants. These alternatives were: (1) directing PCS cooldown on loss of RCP seal cooling, (2) proceduralizing local manual operation of auxiliary feedwater when control power is lost, (3) using a portable generator to extend the coping time in loss of AC power events (to power selected instrumentation and DC power to the turbine-driven auxiliary feedwater pump), (4) providing alternate DC feeds (using a portable generator) to panels supplied only by a DC bus, (5) modifying emergency procedures to isolate a faulted SG due to a stuck open safety valve, and (6) providing hardware connections to allow service water to cool NCP seals (NRC 2007). SNC provided a further evaluation of these alternatives, as summarized below (SNC 2007b).

- Enhancing procedures to direct PCS cooldown on loss of RCP seal cooling - This SAMA is effectively already implemented at VEGP for SBOs by Emergency Operating Procedure 19100-C and for LOCAs by Emergency Operating Procedure 19010-C.

- Proceduralizing local manual operation of auxiliary feedwater when control power is lost - This SAMA is effectively already implemented at VEGP by Emergency Operating Procedure 19100-C.

- Using a portable generator during a loss of AC power to power selected instrumentation and DC power - This SAMA is effectively already implemented at VEGP because the turbine-driven AFW pump can be manually operated without DC power per existing Emergency Operating Procedure 19100-C.

- Providing alternate DC feeds to panels supplied only by the DC bus - This SAMA is effectively already implemented at VEGP because the turbine-driven AFW pump can be manually operated without DC power per existing Emergency Operating Procedure 19100-C.

- Modifying emergency procedures to isolate a faulted SG due to a stuck open safety valve - This SAMA is effectively already implemented at VEGP by Emergency Operating Procedure 19020-C E-2.

- Providing hardware connections to allow service water to cool NCP seals - The purpose of this SAMA is effectively already implemented at VEGP because VEGP uses two centrifugal charging pumps to provide service water for RCP seal injection if the normal charging pump fails. VEGP Procedure 13006 directs operators to establish this system to provide RCP seal injection if NCP is not available.

- SNC indicated that the remaining low cost alternatives identified in the RAI are either not applicable, effectively already implemented or already addressed by existing plant procedures, or not effective at VEGP.

The NRC staff notes that the two potentially cost-beneficial SAMAs identified in SNC's baseline analysis will be considered further through the appropriate VEGP action process (SNC 2007a).

Appendix G

The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the other SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

SNC compiled a list of 16 SAMAs based on a review of: the most significant basic events from the plant-specific PRA, insights from the plant-specific IPE and IPEEE, Phase II SAMAs from license renewal applications for other plants, and review of other NRC and industry documentation. An initial screening removed SAMA candidates that (1) were determined to provide no measurable benefit, or (2) had estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at VEGP. Based on this screening, 4 SAMAs were eliminated leaving 12 candidate SAMAs for evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate were developed as shown in Table G-4. The cost-benefit analyses showed that two of the SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 2 and 4). SNC performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, two additional SAMAs (SAMAs 6 and 16) were identified as potentially cost-beneficial,. However, these two SAMAs were subsequently dismissed based on a higher estimated implementation cost for SAMA 6 and low potential benefit for SAMA 16. SNC has indicated that the two potentially cost-beneficial SAMAs (SAMAs 2 and 4) will be considered further through the appropriate VEGP action process.

The NRC staff reviewed the SNC analysis and concludes that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by SNC are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The NRC staff concurs with SNC's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by SNC is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to Title 10 of the *Code of Federal Regulations*, Part 54.

G.8 References

American Society of Mechanical Engineers (ASME). 2002. "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME RA-S-2002, April 5, 2002.

Electric Power Research Institute (EPRI). 1991. "A Methodology for Assessment of Nuclear Power Plant Seismic Margin," EPRI NP-6041-SL, Revision 1, Palo Alto, CA, August 1991.

IEM, 2006. "Evacuation Time Estimates for Vogtle Electric generating Plant". April 2006.

Southern Nuclear Operating Company (SNC). 1992. "Vogtle Electric Generating Plant Unit 1 and 2, Individual Plant Examination Report," November 1992.

Southern Nuclear Operating Company (SNC). 1995. "Vogtle Electric Generating Plant Unit 1 and 2, Individual Plant Examination of External Events," November 1995.

Southern Nuclear Operating Company (SNC). 1998. Letter from C.K. McCoy, Southern Nuclear Operating Company, to U.S. Nuclear Regulatory Commission. Subject: "Vogtle Electric Generating Plant Response to Request for Additional Information on the Individual Plant Examination of External Events," dated March 31, 1998.

Southern Nuclear Operating Company (SNC). 2007a. *Applicant's Environmental Report-Operating License Renewal Stage for Vogtle Electric Generating Plant Units 1 and 2, Appendix E - Environmental Report,* Southern Nuclear Operating Company, Birmingham, Alabama. June 2007.

Southern Nuclear Operating Company (SNC). 2007b. Letter from Tom E. Tynan, Southern Nuclear Operating Company, to U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Southern Nuclear Operating Company, Vogtle License Renewal Application, Request for Additional Information Regarding the Analysis of Severe Accident Mitigation Alternatives," dated December 20, 2007.

Southern Nuclear Operating Company (SNC). 2008. Letter from Tom E. Tynan, Southern Nuclear Operating Company, to U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Southern Nuclear Operating Company, Vogtle License Renewal Application, Follow Up to Severe Accident Mitigation Alternatives Request for Additional Information, Review Questions," dated February 1, 2008.

U.S. Census Bureau (USCB). 2000a. *1990 Census of Population and Housing, Population and Housing Unit Counts, United States*, 1990 CPH-2-1. Available online at: http://www.census.gov/prod/cen1990/cph2/cph-2-1-1.pdf. http://www.census.gov/population/cen2000/phc-t4/tab01.pdf

U.S. Census Bureau (USCB). 2000b. *Census 2000 Redistricting Data (P.L. 94-171) Summary File and 1990 Census. Table 1 – Counties in Alphabetical Sort within State, 1990 and 2000 Population, Numeric and Percent Change: 1990 to 2000.* April 2, 2001. Available online at: http://www.census.gov/population/cen2000/phc-t4/tab01.xls.

U.S. Department of Agriculture (USDA). 1998. "1997 Census of Agriculture," National Agriculture Statistics Service, 1998. Available online at: http://www.nass.usda.gov/census/census97/volume1/vol1pubs.htm.

Appendix G

U.S. Department of Labor Statistics, Bureau of Labor Statistics (BLS), Inflation Calculator, available online at www.bls.gov.

U.S. Nuclear Regulatory Commission (NRC). 1988. Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," November 23, 1988.

U.S. Nuclear Regulatory Commission (NRC). 1990. *Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants.* NUREG-1150, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991. "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," NUREG-1407, Washington, D.C., June 1991.

U.S. Nuclear Regulatory Commission (NRC). 1996. "NRC Staff's Evaluation of the Vogtle Electric Generation Plant, Units 1 and 2, Individual Plant Examination (IPE)," (TAC Nos. M74485 and M74486)," Washington, D.C., April 15, 1996.

U.S. Nuclear Regulatory Commission (NRC). 1997a. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR-0184, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997b. *Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance.* NUREG-1560, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995.* NUREG/CR-5750, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. "Review of Vogtle Electric Generating Plant, Units 1 and 2 Individual Plant Examination of External Events (IPEEE) Submittal (TAC Nos. M83690 and M83691)," Washington, D.C., December 18, 2000.

U.S. Nuclear Regulatory Commission (NRC). 2003. *SECPOP 2000: Sector Population, Land Fraction, and Economic Estimation Program.* NUREG/CR-6525 Revision 1, Washington, D.C., August 2003.

U.S. Nuclear Regulatory Commission (NRC). 2004a. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission.* NUREG/BR-0058, Rev. 4, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004b. *An Approach for Estimating the Frequencies of Various containment Failure modes and Bypass Events.* NUREG/CR-6595 Revision 1, Washington, D.C., 2004.

U.S. Nuclear Regulatory Commission (NRC). 2007. Letter from J.P. Leous, U.S. NRC, to Tom E. Tynan, Southern Nuclear Operating Company, Inc. Subject: "Request for Additional Information Regarding Severe Accident Mitigation Alternatives for Vogtle Electric Generating Plant, Units 1 and 2, License Renewal (TAC Nos. MD5905 and MD5906)," October 24, 2007.

Westinghouse. Simplified Level 2 Modeling Guidelines, WCAP-16341-P, November 2005.

NRC FORM 335 (9-2004) NRCMD 3.7 — U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1437, Supplement 34
2. TITLE AND SUBTITLE Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) Supplement 34 Regarding Vogtle Electric Generating Plant, Units 1 and 2 Draft Report	3. DATE REPORT PUBLISHED MONTH: April — YEAR: 2008 4. FIN OR GRANT NUMBER
5. AUTHOR(S) See Appendix B of report	6. TYPE OF REPORT Technical 7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as 8 above

10. SUPPLEMENTARY NOTES

Docket Numbers 50-424, 50-425

11. ABSTRACT *(200 words or less)*

This supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by Southern Nuclear Operating Company (SNC) to the Nuclear Regulatory Commission (NRC) to renew the Operating Licenses for Vogtle Electric Generating Plant, Units 1 and 2 for an additional 20 years under 10 CFR Part 54. The SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation regarding the proposed action.

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for VEGP are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. The recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by SNC; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*	
Vogtle Electric Generating Plant, Units 1 and 2 VEGP Southern Nuclear Operating Company Supplement to the Generic Environmental Impact Statement DSEIS National Environmental Policy Act NEPA License Renewal GEIS NUREG 1437, Supplement 34	13. AVAILABILITY STATEMENT unlimited 14. SECURITY CLASSIFICATION *(This Page)* unclassified *(This Report)* unclassified 15. NUMBER OF PAGES 16. PRICE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS